

# 73 Amateur Radio Today

DECEMBER 1994  
ISSUE # 411  
USA \$2.95  
CANADA \$3.95  
A WGI Publication  
International Edition

## BUILD YOUR OWN!

**Kit Builders' Primer**  
**Polarity Protection**  
**6m Vertical Gain**  
**Antenna**  
**CW Operators' Friend**

**More 73 Reviews**

**Ameritron HF Linear**  
**Benchner Chrome Straight Key**  
**Kenwood's Latest Mini HT**  
**Kits from**  
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# The Choice is Yours...

The new IC-2700H or IC-2340H give you a choice of features and budget. Choose the one that best fits your needs. Either way you win ... it's an ICOM!



IC-2700H with supplied HM-92 DTMF Microphone.

## IC-2700H

- ☐ Covers 2 M (144-148 MHz) and UHF (440-450 MHz)
- ☐ 50 W VHF, 35 W UHF (selectable)
- ☐ Detachable Front Panel
- ☐ 3 Channel Scratch Pad Memory
- ☐ Separate Tuning Dial, Volume and Squelch Control for Each Band
- ☐ FULL Remote Control Microphone
- ☐ INFRARED Wireless Microphone (opt.)
- ☐ 3 Repeater Quick Memories
- ☐ 118 Total Memory Locations
- ☐ Removable DTMF Control
- ☐ Auto Repeater Duplex Direction
- ☐ V/V or U/U - Simultaneous Receive of 2 Signals on the Same Band
- ☐ Built-in Pager and Code Squelch
- ☐ 24 Squelch Levels
- ☐ One-Touch PTT with Time-out Timer
- ☐ Tone Scan (w/optional UT-84)



Wireless IC-2700H HM-90 infrared mic (optional).

## IC-2700H

The IC-2700H features a **Detachable Front Panel**. With the optional mounting kit you can mount the faceplate in an easy-to-see location while keeping the main body in a secure place, such as the trunk of your car. With its **Easy to Read Display**, all indications are visible and separate for each band providing safe operation while driving.

The IC-2700H has **Independent Controls and Switches** for each band. Often-used

dials and switches for each band are duplicated, providing true dual band operation in V/V, U/U or V/U modes.

The supplied **DTMF Microphone** provides **full remote control of all transceiver functions**. The optional **Wireless Infrared Microphone** also provides full control. The IC-2700H *can even be controlled by a passenger in the back seat of a vehicle! Talk about back seat driving!*

Transmitted frequencies are *automatically* entered into **Scratch Pad Memories** for easy recall. Each band has 6 scratch pads, 3 for duplex settings (repeater

use) and 3 for simplex settings. The **Memory Allocation Function** allows you to divide the memory channels between bands to suit your preferences - 20 to 80 memories can be allocated to a band for a 2 band total of 100.

The **Auto Repeater Function** automatically selects the proper duplex offset direction, allowing you to work repeaters with ease.

The optional **Tone Scan Function** scans for and sets the subaudible tone frequency being transmitted by another station for you. This is especially helpful when travelling in unfamiliar territory.

## IC-2340H

- ☐ Covers 2 M (144-148 MHz) and UHF (440-450 MHz)
- ☐ 45 W VHF, 35 W UHF (selectable)
- ☐ Independent Controls
- ☐ 110 Total Memory Locations
- ☐ Auto Repeater Offset Function
- ☐ Remote DTMF Mic (opt. UT-55)
- ☐ 14 Autodialing Memories
- ☐ Direct Frequency Input
- ☐ One-push Action Buttons
- ☐ Built-in Duplexer
- ☐ 2.4 W Audio
- ☐ Large, Easy to Read Display
- ☐ Tone Scan (opt. UT-89)
- ☐ Voice Synthesizer (opt. UT-66)
- ☐ Optional Pager and Code Squelch
- ☐ Optional Tone Squelch and Pocket Beep

NEW  
LOWER  
PRICE!



## IC-2340H

The IC-2340H offers **Independent Controls and Switches** for each band (VFO/MHz, Memory/Call, Volume/Squelch and main tuning dial) for **True Dual Band Operation**. Both frequencies are "stacked" for quick visual reference and greater driving safety.

Easy to read in ambient light or direct sunlight, the IC-2340H's **Large**

has 50 regular memories, 2 scratch pad memories, 1 call channel and 2 scan edges).

**One Push Button Controls** allow you to adjust functions on your IC-2340H with a single push of a button. This offers increased operating convenience and safety while driving.

The IC-2340H also offers both an **Auto Repeater Function** and optional **Tone**

## OR...True Dual-Band Operation

IC-2340H with supplied HM-77 DTMF Microphone.

**Display** is easy to view and operate, even while driving.

The IC-2340H features **110 Memory Channels** (each band

**Scan Function**. Just as with the IC-2700H, the IC-2340H will automatically select the proper duplex and offset direction for repeater operations. It will also scan for and set the subaudible tone frequency being transmitted by other stations.

View a video demonstration  
of this radio  
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#RD-2750	27 & 50 MHz Rubber Duck antenna.....	28.
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SIGNAL BAR GRAPH	NO	YES	YES	YES
LOW BATTERY IND.	NO	YES	YES	YES
ONE-SHOT & RESET	NO	OPTIONAL	YES	YES
HI-Z LOW RANGE	NO	NO	NO	YES

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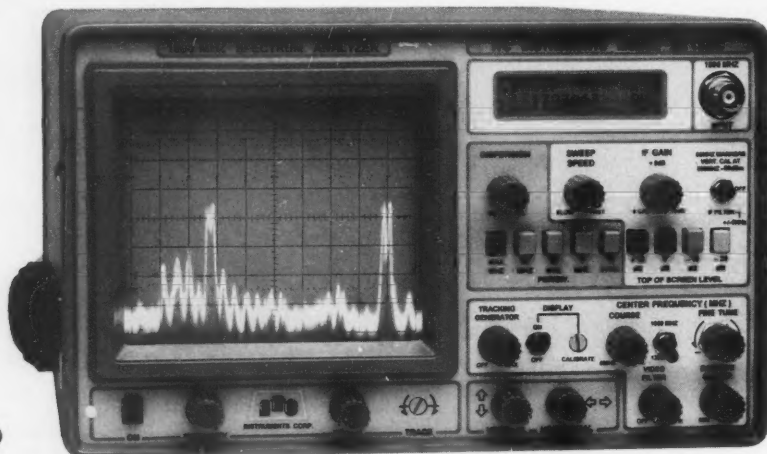
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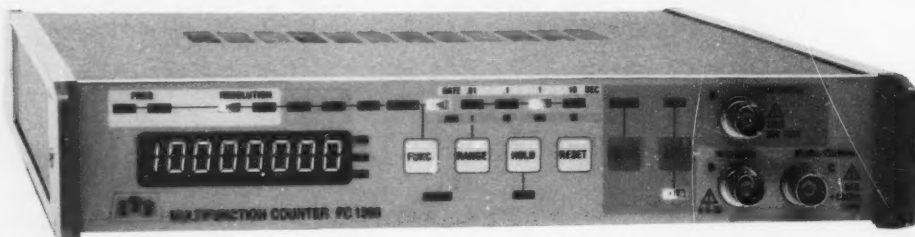
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Would you like to combine beautiful scenery with hamming, camping and bicycling? Turn to page 56.

On the cover: Build your own Oak Hills Classic dual-band.  
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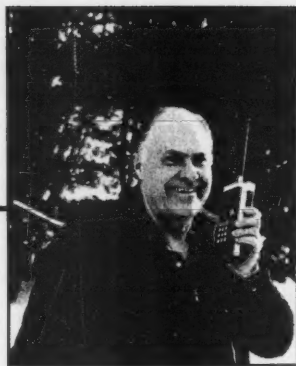
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# NEVER SAY DIE

Wayne Green W2NSD/1



## Yes, I'm an Optimist!

I've been accused of being a doddering old man with a Pollyanna approach to life. Now I admit that I'm a crummy businessman. Always have been. Oh, I know what I should do to make money, but never having had much interest in money, I've always tended to avoid that aspect of business and depend on others to manage the day-to-day business and handle the accounting . . . including my personal investments. And that has encouraged people with scruple deficits to take advantage of the situation, causing me periodic traumas.

I'm enthusiastic about helping to promote new technologies, as I have in the ham radio field with sideband, solid-state, RTTY, NFM, SSTV, repeaters, and so on. As I have with computers, compact discs, and now cold fusion. And I happen to think that amateur radio holds an important key to getting America more competitive with countries like Japan, so I've been plugging for ham growth, particularly for youngsters. I believe that only by generating at least a million new, young hams will we have a good chance of holding onto our ham bands. And whether any of them can copy 13 per is irrelevant. America needs a high-tech work force, not skilled brass pounders.

Yep, I'm old, but I'm not exactly doddering . . . yet. I get out every morning soon after sunup and jog a couple of miles up and down our challenging New Hampshire hills. And I usually put in 100-hour work weeks, just like I did 50 years ago. It's just that for the last couple of years I've been more interested in finding solutions to our country's social problems . . . like crime, drugs, welfare, the deficit, our crooked Congress, wasted foreign aid money, health care, our lousy school system, and so on. And then I got involved in starting a magazine to help cold fusion get out of the laboratory and into production so we could start getting rid of the pollution caused by coal, oil, gas, and even nuclear power. No more smog some day?

When some people I trusted got together recently to try and put me out of business so they could start businesses in competition, I had to

clean house and take over as CFO, general manager, 73 editor, and so on. Oh, I can do it, I just prefer doing creative things to running a bunch of businesses. In addition to managing 73 and *Radio Fun*, there's Uncle Wayne's Bookshelf, the Golden Recording Studios, the Independent Music Producers Syndicate (IMPS), with mail order, distributing, samplers, and manufacturing divisions. Then there's "*Cold Fusion*" and the editor who left to try and start a competing magazine. Fortunately John Kane AB3C stepped in as the new tech editor. He's a retired physics professor who's worked at several universities and put in a few years at Brookhaven and Bell Labs working on particle physics.

Sure, I have my hands full bailing out the mess, but I enjoy a challenge. And once I have everything running fairly well I'll be looking for someone

pressure from my draft board, I left college and joined the Navy. There I was paid a pittance to learn electronics in what I believe was the best electronic school in the world. Then I operated and serviced radio, sonar, and radar equipment on a submarine, making five war patrols. Work? Hal Room, board, travel, education . . . and I got paid. There was a good deal of excitement and danger too, making it more fun. You can read about that in my book, *Uncle Wayne's Submarine Adventures in WWII*.

The government paid me to go back to finish college for two years, then I got my first post-war job as the chief engineer of WEEB in Southern Pines, NC. I was only being paid 50¢ an hour, but I had a ball as an engineer-announcer. I'd have done it for nothing, even with those 90-hour weeks.

**"If you do what you enjoy,  
and get good at it, the chances  
are you'll end up with far more money  
than you ever expected."**

to take the reins so I can write more books, do more teaching, and even try doing a radio talk show.

I was not surprised when hamdom's pinko version of the *Enquirer*, with about as much scruples and credibility, interviewed a couple of my ex-employees . . . who were a major part of the problem, and published a personal attack on me. If any potential employers ever ask me for a recommendation I'll send 'em a copy.

## Are You Being Paid Enough?

I've gotten paychecks all my working life but, in thinking back, I've never worked for a paycheck. The pay was always icing on the cake. I enjoyed my jobs so much I'd have done 'em for free. My first real job was with GE, back in the summer of 1942, testing and tuning transmitters for the Army. Working on radio gear wasn't work, it was great fun . . . and I got paid too!

Then, with some not too gentle

Next I put WPIX (TV) in NYC on the air as chief cameraman. Wow, was that fun! By then I was being paid a big \$70 a week to have fun. At WXEL in Cleveland I made \$80 a week as a TV director. And about the same at KBTU in Dallas as a director. Then there was a stint at Airborne Instrument Laboratories as an engineer, where I pulled down around \$90 a week managing Air Force radar and radio development projects. That was fun, and frustrating. I saw endless millions of dollars being wasted, with the Air Force happily picking up the tab, no questions asked. I really hate to see money wasted . . . probably an old Scotch gene that's kicked in.

But how about you? Are you working for a crummy paycheck, or is the pay just a bonus for doing things you enjoy? If you aren't anxious to get to work every day, and hate having to leave, maybe it's time to re-evaluate. Maybe it's time to look for "work" that

is fun for you.

When I took over as the editor of *CQ* in 1955 I was being paid only \$10,000 a year, but what fun. Imagine, getting on the air and operating as part of the job description. Going on DXpeditions, ditto. Getting to test the latest ham gear. Nirvana. It's no wonder when I got fired from that job in 1960 that I soon started my own ham magazine. I still love trying out new gear, getting involved with new technologies, talking at ham clubs, hamfests, and conventions. That's work? Har-de-har!

And though I've never done any of these things because of the money, for some reason the money has always come in. Oh, sure, I've gotten into financial binds now and then because I haven't paid much attention to the accounting, but it's never taken long to get things perking again. At times far more money than I ever dreamed of has poured in.

If you do what you enjoy, and get good at it, the chances are you'll end up with far more money than you ever expected. And you'll also find that there are plenty of unscrupulous people who are money-oriented who will try to steal it from you.

Speaking (well, writing) about my days at WEEB, one of the writers at the station had had a play produced on Broadway. "*Men Of Iron*." It was about building a skyscraper. When I quit to work for WPIX in New York, Joe came to visit me and show me the script for a new play he'd written. It was about Van Gogh. Unfortunately he put it on the seat of the subway train and forgot it when he got off at my stop. And that was in the days before photocopiers and word processors, so it was his *only* copy.

It was never turned into the BMT lost and found, but about three years later his exact play appeared as a movie, so someone found it.

While I was working for WPIX I got to know a chief of detectives in New York who had an idea for a TV series. True-life stuff. For instance, he explained how they were able to get confessions from even the toughest criminals by taking them around the corner from the station house to a dentist who would drill the suspect's teeth without anesthetic until he confessed. Then he'd fill the holes and no one could prove anything. Thought you'd like to know about that.

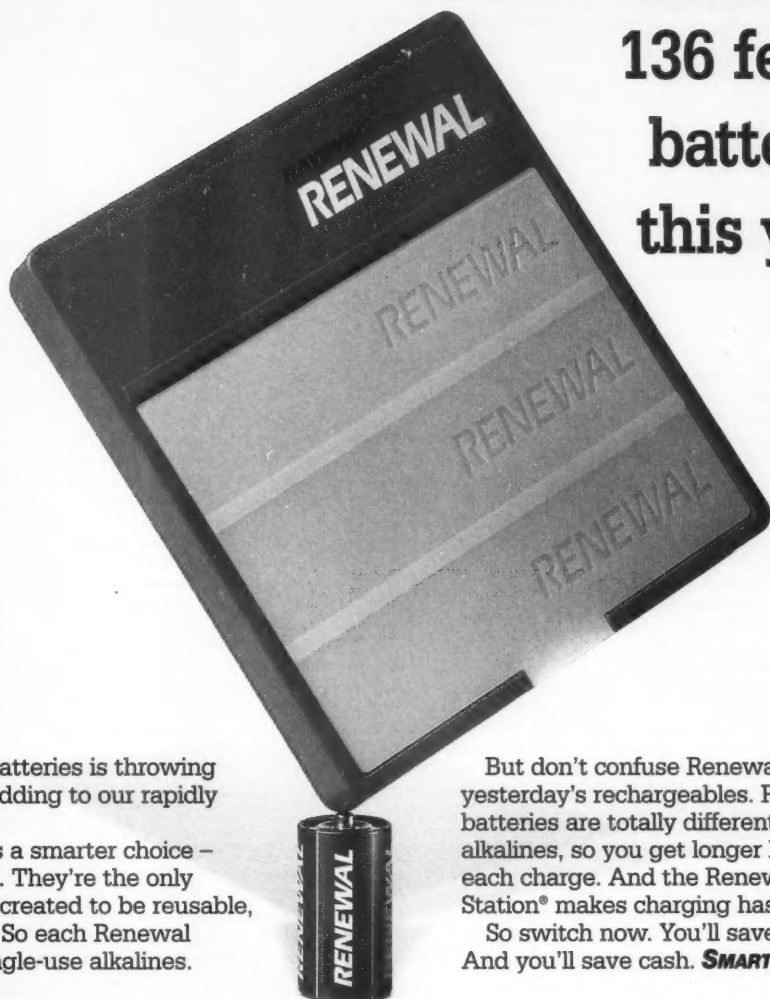
## How's Your Geography?

One of the more exciting aspects of amateur radio is our ability to make friends just about anywhere in the world. A good DXer gets to know every country, and just about every island in the world. So here's a little test (Figure 1, page 76) for you to see how you're doing. No fair looking 'em up. Three points for each you get correct.

Yep, there are some toughies.

*Continued on page 76*

# How to throw out 136 fewer batteries this year.



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# LETTERS

Number 2 on your Feedback card

## From the Ham Shack

Fred Weinberg, Tulsa OK Wayne, while I am not a subscriber, I am a reader and follower of your career. My first radio was a Heathkit Twoer, converted for use for the Civil Air Patrol, and that led me to a career in communications in which I've owned broadcast and print properties.

Currently, I'm helping restore AM radio to its original place in the scheme of things under the theory that if you give me a transmitter that a lot of people can tune in, we'll find a way to capture that audience. It helps that the big boys have abandoned AM as dead because it brings the prices down.

I figure that spread spectrum and digital compression will make TV broadcasters of us all, so it's really the software that counts.

When I think of how far we've come from the days of that Twoer (and, by the way, 72 isn't very old—that's how old Bob Dole will be when we elect him president in 1996), I marvel that there is a place for people who really don't want to work for big companies. But there is.

Wayne, your career has been an inspiration for many of us who would rather not work for anyone but ourselves and I hope that you realize that what you do has an influence far beyond the field of telecommunications.

I hope to read your editorials—fine print and all—well into the future.

Jonathan Walter, Prince Rupert, BC, Canada I've found out personally about the mess in the school system you've been writing about in your editorials. Although I graduated last year, I still am involved with my school. A couple of my friends are teachers there and I am tutoring grade 12 math students. One of those teachers actually helped me in last year's guerrilla attack. He read Gatto's book and agrees with everything in it, but his hands are tied. A few nights ago we got to talking about the situation. I've seen firsthand that the worst damage has already been done by the time kids hit high school. My teacher friend was describing how he would bring in really neat stuff from outside the normal boring curriculum, such as videos and visitors . . . the head of a \$1,000,000-per-year project, for example. The kid's questions weren't about the exciting scientific work he was doing; they wanted to know, "How much money do you make?" While he was explaining about his work, the students talked among themselves and otherwise ignored him, except when he touched on sex, violence, or explosions, then he had their rapt attention. In my math tutoring, I've found they teach nothing but the most fundamental arithmetic in elementary school, so by the time students hit grade 12 they don't have a foundation for learning to understand and use the

new stuff. Grade 12 math is literally a whirlwind tour of all the topics that really need a couple years to soak in. I asked my former math teacher about the curriculum, and why so and so wasn't included, since it would make learning the other things easier. She reminded me why by taking me back to the trivial textbooks that are used in the previous high school years. In other words, those years had been wasted, so all she can really do is push stuff at her grade 12's to memorize so they can pass their provincial exams and she can look good.

In Surrey, a suburb of Vancouver, BC, parents have set up a traditional school, one with discipline and curriculum that go back decades. They did this in spite of intense opposition from the teachers' union. They do realize there's something wrong with the public school system.

*Hmm, maybe it isn't just the code that's a barrier keeping kids away from hamming. Maybe the math is too tough. That Ohm's Law is a toughie, right? . . . Wayne*

Richard Gillmann K17KJ, Isaquah WA Wayne, I enjoy reading your "Never Say Die" column every month in 73. You've often written about how the growth of amateur radio and school radio clubs stopped in the early 1960s. While, no doubt, incentive licensing had its effect, another factor influenced me at the time.

I was in a high school radio club in 1963, at Homewood-Flossmoor High School in Illinois. My friends and I were fascinated by electronics, and we were studying the code and theory for our Novice licenses.

One day, our school announced a weekend program that would let us use the computer lab at the Illinois Institute of Technology. We could run programs on their IBM 1620 and later IBM 7044 computers. All we had to pay for were blank punch cards. (Remember, this was the Stone Age of computers!)

We all jumped at the chance. We were down there every Saturday. Soon, we knew more than the teachers. It was exciting, it was the forefront of technology, and it turned into a career for me.

The radio club, neglected, went into a tailspin. The new computer technology was more interesting to us than the old radio technology. The generation of kids that followed us had teletypes connected to time-sharing systems, and the generation after that had personal computers, to make the experience even more enticing. Now they have the Internet.

I did eventually get my Novice license, but never operated. In the '80s, I got an Advanced ticket so that I could try packet radio. I built a TAPR TNC-2 kit, figured out how to wire a cable to

my Icom IC-2AT, and connected to all the PBBSs I could reach on 2m. I was disappointed to find out how dull the PBBSs were, compared to telephone BBSs and to the Internet. There weren't many callers, and what they had to say wasn't very interesting.

For amateur radio to thrive, we need to find a way to make it more appealing to computer hobbyists. You don't need a license to access the Internet; there are no restrictions on message content, and you can automatically forward anything. This is what we have to compete with. Recent FCC rulings have been in the right direction: no-code Techs, and relaxed rules for message content and automatic forwarding. I'd like to see the FCC go further in this direction.

Here's my proposal: For the ham bands above 500 MHz, eliminate the license requirement entirely, and remove all restrictions on message content and forwarding. These UHF/SHF bands could benefit from more activity. The originator of a message would be solely responsible for its content.

This would lead to a great expansion in wireless computer networking by amateurs. More participants gives you more people to write to and chat with, more varied postings, more files to download, and richer content in general. A bigger network works better in emergencies, too. We could have a big branch of the Internet over the radio, accessible for free to anyone with a computer, a radio and a TNC. Now, that would be exciting.

Tom Prentiss, Calvert City KY Wayne, I recall when 73 Magazine was about 5" x 8" in size, and the cover price was \$.37. I had always enjoyed your outlandish editorials, and was a particularly big fan of yours when you were trying to establish a counterpart to the ARRL. I even drove to Peterborough one summer to interview with you for the director's job of that fledgling organization.

Having the usual excuses for not keeping up with that hobby, (except for faithful renewal of the license) I've only recently begun to rekindle my interest, and for the first time in years I've bought a ham magazine (73 Amateur Radio Today, October 1994). I congratulate you, in your advanced age, for maintaining your sense of humor and provocative thought process.

I'm certainly aware that 73 is a ham magazine, and should mostly be oriented to that pursuit; however, since you are asking for the readership to submit ham projects and articles for publication, why not go one step further? Why not solicit features of any type for publication? After all, you are the one constantly admonishing others to get off their duff and do something productive. You also surely know that many ham readers simply do not have the expertise to write something of a technical nature. There may be a Hemingway in the wings, and for all the bureaucracy involved in the normal publishing merry-go-round, unable to get published. Enter Wayne Green, and 73 magazine.

Sure, there would be some costs involved, for logistics and compensating the author (me, pay?), but I can foresee the readership, and the number of subscribers, growing.

For more than 30 years I've been chiding myself to write to Uncle Wayne, and I've finally done it. I imagine your hope is that it will be another 30 before I do it again.

*Tom, Thanks for the nice letter . . . glad you've been enjoying my editorials, even when they have little to do with amateur radio. Well, I can't help sharing my enthusiasms.*

*I would like to see ham-oriented stories, poetry, cartoons, photographs, and so on. But, if I get too far afield I'll get beefs. True stories, fiction, fantasy and humor will be welcome . . . Wayne*

George Zimmerlee N4XDC, Marietta GA Some of us are wondering how you will respond to this letter. Everyone knows that you hate the League. Some also know you hate traditional values and Christians. It is anybody's guess how you're going to land on this one, but here goes: I have proof that the FCC and the FBI worked together to jam amateur radio service stations AB5LA and AB5KZ at EE Ranch Road, or RR7, Box 471-B, Waco, TX 76705. This is also known as Mount Carmel Center, the church/home of the Branch Davidian Church. Also in this same jamming operation, already admitted by an FBI special agent on April 17, 1993, was the jamming of radio and TV stations for political reasons, (this also has been admitted) as part of their psychological operations.

The amateur station was operating under sections 97.1, 97.11, 97.113, 97.301, 97.403, 97.405 of the Amateur Radio Service rules. This is the Communications Act of 1934. Also violated by Big Brother were Articles 44 and 45 of the International Radio Regulations, and Article 19 of the International Covenant on Civil and Political Rights.

Mark Wilson, Editor of QST, knows that the amateur service was a victim of this deliberate interference to a "station-in-distress" in the amateur service. Wilson just doesn't care about this war of the tyrants in government against the amateur service. This should not be any surprise to either of us, but I found it interesting that the League would put itself in jeopardy by refusing to print anything about the jamming. Not one word of it will be printed, not even the part already covered by the mainstream news media.

I have some hope that you will pull through and be consistent in your opposition to League Lunacy, but no one can be sure. If this story makes it to the pages of 73, you will scoop QST, CQ, Popular Communications, and Monitoring Times.

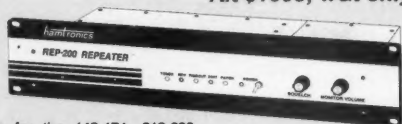
*George—Sure, what's a got? However, if your "everyone knows" information about my "hates" is as accurate as your Waco information, it isn't going to be of much value . . . Wayne*

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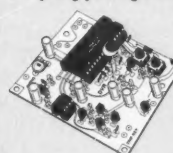
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**TD-4 SELECTIVE CALLING Module.** Versatile dtmf controller with 1 latching output. Mutes speaker until someone calls by sending your 4-digit id code. Or use it with a long id zero digit to alert anyone in club. Also may be used to control autopatch or other single device. .... kit \$49, w&t \$79

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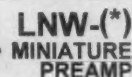
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- GaAs FET Preamp similar to LNG, except designed for low cost & small size. Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

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- GaAs FET Preamp with features similar to LNG series, except automatically switches out of line during transmit. Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

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Low noise converters to receive vhf and uhf bands on a 10M receiver.



- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).
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## Reality Check

You have to wonder if it is more fitting to dignify false accusations by responding to them with the truth, or is it wiser to simply ignore them, to turn the other cheek? We offer this compromise: *Here is the issue of 73 that a certain few overzealous rumor-mongers said would never be printed!* And there will be many more issues to follow.

73 has been around for 34 years so far, and we feel our loyal supporters need to know we're here to stay. To those few who deliberately tried to put us out of business, and you know who you are; we hope you have a good lawyer.

## 73 Photo Search Finds Success

Dozens of the 73 faithful have blown the dust off their camera lenses and taken to the streets of hamdom in search of the perfect cover shot. We are certainly encouraged by the quality of the work being submitted in the 73 Photo Search, and we'd like more of you to give it your best shot.

Our first amateur photo appeared on last month's cover. It won notoriety and fame for Jose Rivera KP4FMD, as well as a free year of 73 magazine! Jose and his wife Maria WP4FRO faxed our office when they saw their photo. "We could not believe our eyes when we saw our picture on the cover of your magazine. This was really a wonderful surprise," they wrote.

So what's holding you back? Suitable subjects would include ham radio equipment, amazing antenna arrays, or better yet, catchy ideas of your own.

Our format calls for a color photo which is: 1. Vertically oriented; 2. Sharply focussed; 3. Leaves extra room at the top and left side; and is 4. Not too busy. We prefer 35mm prints.

Send your color prints to 73 Photo Search, 70 Route 202 North, Peterborough, NH 03458. Please include a brief description of your photograph, your full name and callsign, and your permission to publish. We cannot return photos without an appropriately-sized SASE. If we do not use your photo on the cover, perhaps we'll find a spot inside. We might even use it in our sister publication *Radio Fun*. Good luck and happy shooting!

## FCC Slaps VEs, Cancels Upgrades

The Federal Communications Commission has begun proceedings against three suspended volunteer examiners and has downgraded fifty-one amateur licensees after an extensive fraud investigation in Southern California. According to the "Westlink Report," Extra

Class Licensees James B. Williams AA6TC of Wilmington, CA; Robert L. Flores N6WPQ, and his wife Rose Marie Flores N6WPR of Santa Monica, CA were ordered to turn in their licenses. The FCC believes all three conspired to commit fraud in at least one instance in violation of the rules and regulations governing participation in the volunteer testing system.

The FCC has also acted to punish 51 hams who either refused to take retests or failed their new exams as part of the agency's ongoing investigation. Investigators say at least one test session never actually took place. Indications are that this is just the tip of a very large iceberg, and more disciplinary actions by the FCC may be forthcoming. *TNX Westlink Report, No 682, October 13, 1994.*

## Bye Bye BBS

The 73 BBS has been dead for several weeks now. It apparently caught a virus and croaked before the ambulance arrived.

We're considering upgrading to a faster, more powerful, Macintosh system but nothing is definite yet. Surprisingly few people have noticed that the old BBS has been down. Does anyone care? If so, drop us a line. We'd like to hear from you.

## 73 Staffer Wins Ozzie

73's Graphics/Production Manager Linda Drew has been awarded a Silver Ozzie Award for Publication Design Excellence for her work on Wayne Green Inc.'s "Cold Fusion" magazine.

Winning the coveted Ozzie is a major achievement in the publishing world. Entries were considered from many of the best-designed publications in North America. Linda has been on the staff at Wayne Green Inc. since 1978 and we enjoy the benefits of her work every month. Good going, Linda!

## Dial FCC Toll-Free

The Federal Communications Commission has installed a new toll-free telephone service at Gettysburg, Pennsylvania. The 800-number is now available for customer service inquiries at the licensing division.

The number is (800) 322-1117 weekdays from 8 a.m. to 4:30 p.m. Eastern Time. It gives you access to an automated system which will record your requests for forms and records, complaints, and requests for information.

The commission instituted the new number after a presidential order that the federal government be "customer driven." The FCC conducted research to determine the need for the 800 line. Within the next year and a half, the FCC plans to institute other customer service improvements to comply with the White House directive. *TNX Florida Skip, Vol. 36, No 10, October, 1994.*

## Ham's Project Takes Off

A New York amateur radio operator expects her scientific experiment to take off soon aboard an upcoming space shuttle flight. Daina Steiner N2MIA is a researcher at the Hospital for Special Surgery in New York City. Her project is a study of cartilage mineralizing culture systems. This, she says, is crucial to the understanding and treatment of osteoporosis and other bone diseases.

Steiner recently spent a week at Cape Canaveral on a run-through with the NASA launch team. Her project is slated to fly aboard the Endeavour STS-66 by year's end. *TNX Westlink Report, No 682, October 13, 1994.*

## Kid Power

Carole Perry WB2MGP is looking for good speakers under the age of 18 to be presenters at the Dayton '95 Youth Forum. Children should contact Carole for an interview. Her address is at the top of her column "Hams With Class" on page 60. Or phone Carole at (718) 983-1416.

Carole would also like to encourage adults to bring a child or young adult to the Hamvention. Support the future of ham radio!

## DXpedition Needs a Hand

The South Georgia Island team of AI WA3YVN (VP8SSI), Jan WA4VQD, and Vince K5VT will operate for at least 15 days from South Georgia Island January 4-19, 1995. They will have three HF stations on all bands CW, SSB, and RTTY. They are well equipped for low band and new band operation.

The team will arrive in the Falklands on December 23, 1994, and will operate on the low bands and the new bands for about five days while awaiting the departure of the R/V Abel-J. This is the same ship that transported the VP8SSI team in 1992.

Donations are needed to support this DXpedition. For information contact SGI DXpeditions, P.O. Box 2235, Melbourne, FL 32902. QSL cards will be handled by INDEXA, c/o John Parrott W4FRU, P.O. Box 5127, Suffolk, VA 23435.

## TNX...

... to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, 70 Route 202 North, Peterborough, NH 03458. Or you can FAX us at (603) 924-9327. News items not published in 73 often find their way into our sister publication, *Radio Fun*, a special monthly magazine for new hams. We welcome news and interesting photographs from the world of amateur radio.

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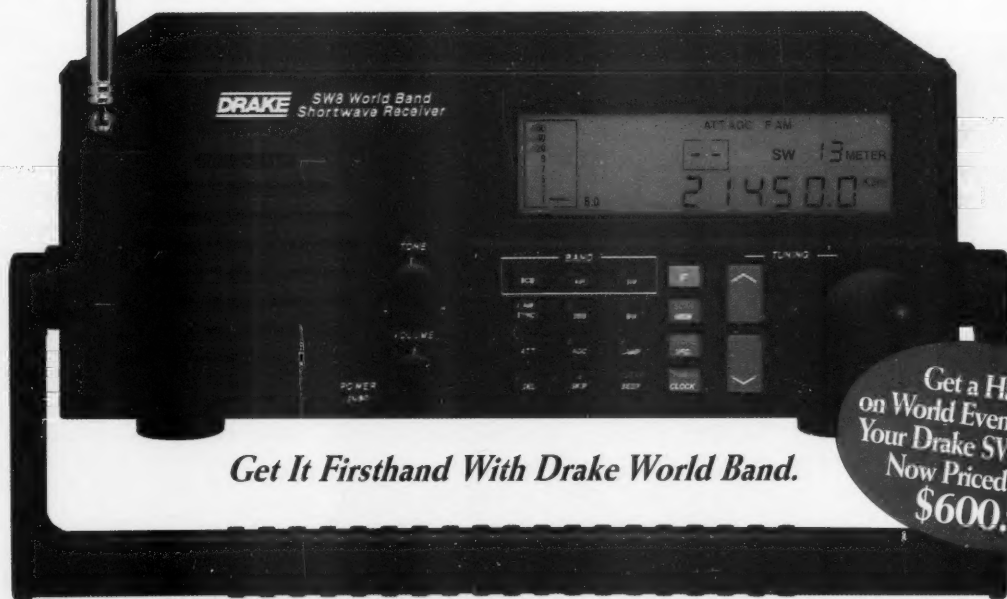
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CIRCLE 147 ON READER SERVICE CARD

# Kit Builders' Primer

*Yeah, I built that.*

by Mike Bryce WB8VGE

Nothing brings a smile to my face faster than the smell of molten solder. In fact, I really enjoy building my own equipment. A Friday night, a 10-pound bag of Oreos, two cases of Diet Coke, a new PC board and whoa! An all-night building binge is underway! Throw in some CW coming from the ARK-40 with a dash of the *X-Files* running on the TV in the background and you have my idea of ham heaven. Even if the project I'm working on does not work when it's done, I still have fun building and then troubleshooting the circuit. And when I'm all done, I take a deep breath and say, *Ooooo, let's do it again!*

If you've never heated up a soldering iron before, this is the time to get going. In the past, many of the projects in magazines like *73*, *Radio Fun*, and *QST* required several parts orders to gather all the pieces parts together before solder touched copper. Now, there's a flock of people putting kits together for some of the more interesting projects.

Electronic kits are an easy way to start yourself on building your own ham gear. Usually all the necessary PC board compo-

nents are supplied, as well as a PC board. Sometimes you can even get a nice-looking case to house your project in.

## Hail to the Heath

Mention kits, and everyone thinks of Heathkit. They are still the standard by which every kit produced will be compared. That's saying a lot since Heathkit is no longer making electronic kits. What set Heathkit apart from everyone was their manuals. The manuals were clear, concise, with plenty of drawings at every step of assembly. It took a lot of labor and time to produce a manual for Heathkit.

## Today's Kits

You won't see a Heathkit-type manual today, although some of the kits I've assembled are getting close. Many of the kits I've run across are known as *BOPs*. A BOP? Yup! A Baggie Of Parts. Throw in a sheet or two of instructions or guidelines, a PC board overlay, and there you go! A BOP kit usually makes the Friday-night building binge interesting.

## The Fine Art of Kit Building

Before you open up the kit, you need a place to work. Pick a place where you can let the kit just sit if need be. Don't use the family dining-room table. Besides the mess, a misplaced soldering iron will really cook a tabletop.

Next, the work area should be uncluttered. In my workshop, cleaning the top of the workbench is a job in itself—I know I could build a CAT scanner just from the parts laying around! There's nothing worse than finding an extra 6.2k resistor and not knowing if this part is for the kit or just laying around. A clean, well-lighted work area is a must-have for any kit building.

Most people will tell you to sort and count off all the parts in your kit against the parts list. I don't. To me that's a waste of time. You'll know if you're missing a part when you come to it.

While you're putting together your kit, you may find a part missing. I never panic, but simply mark on the overlay that a part is missing and continue on with the assembly. I've found in the past that the missing part shows up. Never, ever throw out any of the packing material that came with the kit. A missing diode or connector may be lurking inside a foam peanut.

I lay a sheet of paper down on the workbench, then place all the resistors in one pile, all the capacitors in another pile, and all the semiconductors in another. When a 10k resistor is called for, I wade through the pile until I find one. The paper adds contrast so you can see the color codes of the parts easier. It's especially helpful with resistor color codes. The paper will also reflect light up so you can read the markings on the diodes and transistors much easier. And, if you mislay a part, it is much easier to spot on the paper. Depending on the complexity of the kit and the amount of parts used, I take a pencil and mark the name of each pile on the paper. A small drawn arrow points to the correct pile of parts.

If the kit has some of the parts in small envelopes or bags, never open them up until that part is called for. This way, you'll never risk installing U3 instead of V3.



Photo A. The complexity of the instructions typically increase as the complexity of the kit increases. (Photo by Jeff Gold AC4HF.)

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MFJ-285L, MFJ-287,  
MFJ-287 or MFJ-287L  
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MFJ-1024 \$29.95

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MFJ-1702B



MFJ-1704

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MFJ-1704, \$59.95. 4 position cavity switch with lightning/surge protection. Center ground. 2.5 KW PEP, 1 KW CW. 50 dB isolation at 500 MHz. 50 ohm. 6 1/4x4 1/4x1 1/4 in. MFJ-1704N, \$69.95, N connectors.

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MFJ-264, \$59.95. Versatile UHF/VHF/HF 1.5 KW load. Low SWR to 650 MHz, usable to 750 MHz. 100 watts/10 minutes, 1500 watts/10 seconds. SWR is 1.1:1 to 30 MHz, below 1.3:1 to 650 MHz. 3x3x7 in. MFJ-264N, \$69.95, N connector. MFJ-5803, \$4.95, 3 ft. coax/PL-259.



MFJ-260B



MFJ-264

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## Code Practice Oscillator



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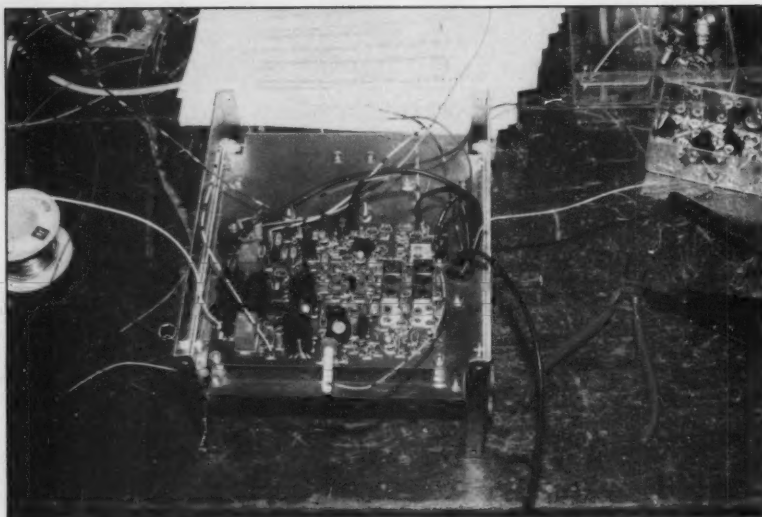


Photo B. Here we see the Oak Hills Classic QRP rig kit starting to take shape. Check out the review on page 14. (Photo by Jeff Gold AC4HF.)

Before any solder hits the PC board, I always look over the PC board for any signs of damage or under-etched copper. A tiny spot of copper between two pads is all it takes to cause trouble. When stuffing the PC board with parts, I make a mental note of the traces and pads. Pads that are supposed to be connected can look like a solder bridge. This way, I avoid the hassle of desoldering a good joint. Depending on the kit, a PC board foil pattern may be included. This really helps you to find and detect solder bridges as you assemble your kit.

Because there are so many resistors in any given circuit, they go on the PC board first. Just because the leads on resistors are long does not mean you have to use the whole lead. Unless directed otherwise, resistors mount flat against the PC board, and not up in the air an inch or two. The same goes for diodes and axial capacitors. Push them both down against the board. Although not really necessary, I like to place all the resistors with the color codes all pointing in one direction. It makes troubleshooting a bit easier if you don't have to constantly flip the PC board from side to side. Besides, a PC board is a piece of artwork!

I do the same for capacitors, too, as long as they are not polarity sensitive. By inserting the capacitor with the lettered side out, you can check your work much easier.

When installing diodes, resistors or axial capacitors, bend the leads slightly away from each other after you have passed their leads through the holes in the PC board. Don't bend the lead flush to the board—doing so will almost guarantee a solder bridge.

I mount IC sockets, trimmer capacitors and pots with one or two leads, check the mounting, and then solder in the remaining leads. Again, be sure you have everything down flush on the board.

Semiconductors are in a class by themselves. They must be installed the right way

or the circuit won't work. There is also the possibility of toasting the semiconductor. I mount TO-92 style transistors about 1/4" above the board. This leaves me enough room to get a test probe on the leads, but short enough to prevent critters from developing because of excessive lead length.

Unless the instructions say otherwise, don't use IC sockets in circuits using high-speed or high-frequency ICs. The extra lead length will cause havoc with the circuit. Phase-locked loops are especially touchy about IC sockets. However, sockets are a good idea, especially when using a double-sided plated-through-hole PC board. If you have any doubts, a call to the kit's manufacturer should clear things up.

Take breaks. There's no rush, this is not a contest to see how fast you can assemble a circuit board. Kit building is supposed to be fun, not a race to see who gets done first. Take time out to rest your eyes.

I always leave a radio cooking in the background, listening for CQs. When I hear one, I roll my chair over to the rig, and with a bit of luck, I'll have a QSO. And, you'll have something to talk about besides "The rig here is Kenwood and the weather is warm!" If nothing else, get up and add some ice to the Diet Coke and grab another fistful of Oreos.

#### Surplus Parts and Parts Substitutions

You'll find a lot of surplus parts in kits. There's nothing wrong with the practice. Most of the surplus parts are prime number-one-grade components. Most are made for the military or consumer market. Surplus parts are usually better than the honest-to-goodness parts. This is especially true if you end up with mil-grade goodies.

Let's say our kit calls for a 2N2222 transistor. Instead, you find inside your kit a XCX345/SXC. What you got is a surplus NPN transistor made by who knows who. It

will work in the kit. There's a good chance it was made for the military, costs the government (you and I) \$34 each and now the military can't use this part anymore because of design changes. A parts broker purchased three tons of them and is selling them off for a dollar a pound. That's how you and I end up with surplus parts in those BOPs.

Surplus semiconductors are not bad, but surplus capacitors can be a real pooper! A 0.1 capacitor is a 0.1 capacitor for almost all projects. But if the PC board is laid out for a lead spacing of 0.2 inches and the surplus capacitor has 0.7 lead spacing, whoa! It's not going to fit! Just like a fat lady with a pair of tight jeans, with a lot of pushing, shoving, pulling, you can get the part to fit the board, but it's not going to be a pretty sight!

There may be a part or two that the kit supplier has substituted. There's no need to panic, as most substituted parts will cause no noticeable difference in the way the project performs. If the original article called for a 1.1  $\mu\text{F}$  cap, and the kit has one that's 1.5  $\mu\text{F}$ , that's just fine. As long as the working voltage of the capacitor is as high or higher than needed, you'll have no trouble. Most of the electrolytic capacitors have a working voltage of 16, 25, or 35 volts. Of course, there are many more values to pick from but these are the ones you'll see the most. If the schematic calls for 4.7  $\mu\text{F}$  at 16 volts and your kit has 4.7  $\mu\text{F}$  at 35 volts, that's just fine. Solder him in and move on to the next component. (I've found that active parts like transistors and ICs are female, resistors and capacitors are male.)

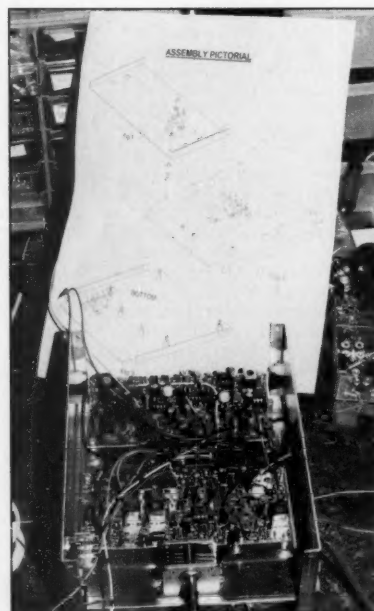


Photo C. You'll want to work in a comfortable location where you can leave the partially-assembled kit undisturbed. Don't use the kitchen table! (Photo by Jeff Gold AC4HF.)

## Instructions and Manuals

BOP kits are not noted for their instructions. Most BOPs consist of a photocopy of the original article, a parts overlay for the PC board and a sheet or two of additional instructions. Most of the assembly work must be done by the builder! If the instructions say to "install the resistors," that's what you do. Usually, as the complexity of the project increases, so do the instructions—unless it's a Kanga kit. Then you're on your own!

Before you do any soldering, it's a good idea to look over the instructions of the kit and do a dry run through. Make a note to yourself of any part of the instructions you're not clear on. A good dose of common sense is your best weapon. If it sounds really stupid, it probably is. Double-check this step before you move on. I can look past most errors in a kit's instructions. If you're told to install an RCA jack on the PC board and there's no way it will fit, then there's an error in the instructions.

Locate the proper part and install it on the board. Make a note of the error on the instruction sheet.

## Soldering

I've melted a lot of solder in my time. I think I'm fairly good at the task, but every now and then I screw up royally. Over 90 percent of the kits returned to Heath did not work because of poor soldering.

I use two different soldering irons for kit building: An 18-watt Antek iron for small work, and a larger 45-watt iron with a big tip for heavy-duty work for soldering in connectors and such. Keep a spool of desoldering braid handy to clean up any mistakes.

Don't try to cook the PC board with an iron that's not hot enough. Soldering is a lot like kissing your aunt—you have to be quick, do a good job, and leave no slobber. All your solder connections should be bright and shiny.

## Troubleshooting

The odds are in your favor, but every now and then one of the kits I finish up with won't work. I start by looking at every solder joint. I especially check any odd-looking *clump* of pads for solder bridges.

If I find none, then I look at a misplaced resistor. It's so easy to put in a 470-ohm resistor in place of the 47k resistor. Equally useful, but hardly interchangeable! I check for like values, as in the example above, in case I have mistaken them during assembly. After I check the resistors, I move on and do the same for the capacitors. If I don't find any problems, I move on to the semiconductor, and so on until I'm sure there is no problem with the way the kit went together. Usually, the problem can be located and fixed without too much trouble.

Kit building is a lot of fun. For me, it's solder fume therapy, as I get totally involved with a kit. Why, who knows, maybe you'll soon be saying, "Ooooo, let's do it again!"

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CIRCLE 51 ON READER SERVICE CARD

73 Amateur Radio Today • December, 1994 13

## 73 Review

Number 5 on your Feedback card

by Jeff M. Gold AC4HF and Daniel Wee

# The Oak Hills Classic

*Dual-band QRP kit.*

Oak Hills Research  
20879 Madison Street  
Big Rapids MI 49307  
Telephone: (616) 796-0920,  
FAX (616) 796-6633.  
Price Class: Kit—\$219.95;  
Optional keyer—\$39.95

I like to build all levels of projects, but sometimes I really like to sit back and just enjoy building up a project that I know will not have any surprises for me in the way of unclear directions, or directions filled with mistakes or poor performance of the kit when it is completed. I have built many of the Oak Hills' kits. I have enjoyed building every one and they all worked well when completed. Oak Hills takes great care in providing top quality parts and clear and easy-to-follow directions.

The Oak Hills Spirit that I built for 20 meters was one of my favorite rigs to build and operate. When I heard that Oak Hills was going to sell a kit that was designed as well as the Spirit and was a 20/40 meter rig, I got excited—I spend most of my time on 20 and 40 meter CW/QRP. Having one rig that I could build myself, that would operate on both bands, and would run off a gel cell really appealed to me.

### The Parts

I usually build larger projects in stages. I open the parts for one section at a time and separate out the various types of parts. Then, for example, I will put all the resistors on a piece of paper labeled with their parts numbers and do the same for the rest of the parts. This helps me check to make sure all the parts are included and also helps avoid one of the biggest pitfalls in building: putting a part in the wrong place.

The parts for each section of the Classic are bagged separately. The boards are about the clearest silk-screening I have come across and they have plated-through holes. The back of the board is coated over to help avoid the second big pitfall of building kits: solder bridges. All the coils are pre-wound to help the kit go together quicker and avoid problems that many builders have with winding their own coils. The instructions are excellent; Oak Hills employed an illustrator who used to work for Heathkit. The case is nicely screened and is really good quality. After seeing how easy the kit looked to put together (the parts are fairly close together on the board, but this shouldn't present much of a problem), I decided to separate out the parts into little plastic parts bins and not take the time to label every part.

### Assembly

My wife does beautiful needlepoint and other crafts of this type. I always ask her why she doesn't enter some of them in the County Fair. She says she can't do that because although they look great from the front, the back side of the work isn't perfect. This is the way I usually operate with my building. If I am building a lot of kits, the kits usually work well, but may not be the prettiest things you have ever seen. My goal for this project was to be able to enter it in the County Fair and have anyone look at the bottom of the board and say how pretty it was. I knew I was going to keep this rig for a long time if it worked the way I thought it would, so I decided to really take my time building it.

I found the kit went together very quickly, even though I really took my time. I had no problems with the directions and never found a case where the instructions were ambiguous. I would rather just have a parts overlay and schematic than ambiguous directions.

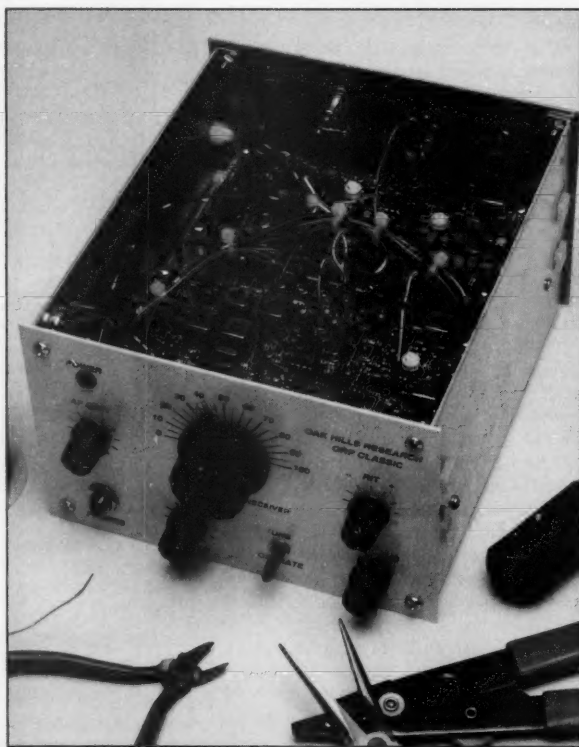
With the optional iambic keyer there are four printed circuit boards to build. There are separate boards for the oscillator, receiver, transmit/receive, and a small board for the keyer. Each section comes with separate bagged parts, and overlays, which makes the kit much easier to build.

### Alignment

The alignment procedure was

fairly straightforward and didn't take much time. It is recommended that you have a frequency counter to adjust the oscillators. Separate adjustments are made for the 20 and 40 meter band sections.

After I knew the rig was working well I went back and readjusted the coils in the oscillator section a little differently than the instructions called for. I found that following the instructions gave me the full bandwidth on both bands, but the analog meter that is silk-screened on the case was a little off. By readjusting the coils and playing with them I was able to get the rig so that the panel frequency indication was right on the money. This is one of the only rigs on which I have been able to get the reading to be accurate for the whole bandwidth. I would suggest that you follow



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- Basic display lets you know exactly where you are.

14.03510-T 0930  
14.03510-R 0000

- Standard Display shows RX/TX VFO freq's, time and current memory

- Send & Receive in:  
CW / RTTY(BAUDOT) / ASCII

TNX FER QSO, 73

- ← Incoming data
- ← Outgoing data appears here

- Store up to nine 256 character messages.

14.03510-T 0930  
3> CANNED MSG

- Messages can be: edited, sent & appended to outgoing message

- ← Format & Edit stored MSG's here

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CIRCLE 321 ON READER SERVICE CARD

the alignment procedure first—you may find that it works out correctly for you if you follow the provided instructions.

### Circuit and Design

The OHR Classic dual-bander is invariably one of the best receiver designs I have seen on the kit market. Part of the strength of the circuit lies in its use of extensive filtering in the front end and IF stages. The use of the diode-ring mixer (the TUF-1) also results in a good dynamic range and the receiver is essentially a low noise one.

Looking at the circuit, you will find that all the switching is solid-state, including the T-R switching. This is a good scheme and you won't hear any relays clattering away as you send code. All the switching diodes are biased at a common rail. Another area where diode-switching is employed in this circuit lies in the band-changing circuitry. Essentially, the band switch uses the diodes to switch in one of two band crystals for the LO and to switch in the appropriate band-pass filter. (It would have been nice if they had used hot-carrier diodes for this).

The circuit itself is a classical one (no pun intended). It comes with an RF-preamplifier stage to provide some front-end gain to compensate for the filter insertion loss. This is a standard negative feedback broadband preamp and is unconditionally stable. The 2N5179 is also a low-noise device so that helps somewhat. The diode-ring mixer is then terminated in a diplexer and a post-mixer amplifier before going through the standard four-pole crystal ladder filter. The use of the MC1350 permits IF AGC, which is audio-derived.

The product detector uses an NE602AN, which seems to work fine at this stage (after the AGC) since overloading can be easily controlled, and provides some conversion gain (12 dB or so) as well.

There is an audio preamp stage before the audio is fed into a permanently wired audio bandpass filter. This is not a very narrow one and I suspect that its purpose is to get rid of wideband IF noise products. Finally, there is an LM-380N-8 final audio amplifier which is under-driven for low THD figures.

The VFO/LO is built on a separate board which helps isolation and stability. It is well-buffered before being fed into the diode-ring mixer, but a drawback here is that the mixer injection signal is sometimes on the low side and is not constant for the two bands. LO signal levels should be +7 dBm (ballpark) for good performance. The problem here lies in the oscillator, which does not perform too well at the higher crystal frequency (18.000 MHz). Perhaps the MPF102 could be replaced with a 2N4416.

As you can see, this is a very straightforward design and its strength lies in the fact that OHR did not skimp on filtering and matching impedances.

The TX side of the board is cleverly designed to reuse the RX mixer section so there is no additional mixer for the TX side. Similarly, the bandpass filter for receive is also reused for transmit. A good scheme, really, and economical too. After the bandpass filtering there is a two-stage driver, which is essentially Class-A amplifiers, before the final Class-C amplifier (2SC2075). This is followed by the mandatory low-pass filter. The switching is all solid-state, of course, as I have mentioned before, and looks very well implemented.

### Performance

The performance of the rig attests to the soundness of the design. My one gripe is the permanently fitted audio filter which is used to filter out wideband IF noise. I would have been much happier if this noise (6 dB) could be prevented in the first place, or to have some pre-product detector filtering. Ah, well, you just can't always have the cake and eat it as well, can you? A very good design and performer (as many will tell you), overall.

There are two aspects to every kit building experience. The first is the building experience. With the Classic, this phase was a clear winner and rated at the very top of its class. The second aspect is how it performs. I have found that even with all the rigs I have hooked up on my operating bench, I end up using the Classic a lot. I really am impressed with the smooth solid-state QSK. I hate relay switching. I find that even though I really like my expensive Kenwood 850S, the relay QSK bothers me. I prefer the switching on the Classic a lot better. I find the receiver to be both sensitive, so that if the signal is out there—I am hearing it—and selective—I am easily able to separate out signals except during the most crowded band conditions. I have also found the VFO to be stable. I don't like having to chase signals across the band while I am in the middle of a QSO.

The RIT has a center detent, which makes it easier to use. The tune/operate switch comes in real handy for me. I have a resonant quad for 20 meters, but find that on 40

my vertical needs an antenna tuner to get the SWR down. I find this a lot easier to use—having the tune switch so that I don't have to have a manual key to keep the rig keyed. I also like the fact that you can change the transmit power easily without having to take the cover off the rig. This makes it easy to experiment with different power levels. My rig puts out about 5 watts on 20 meters and about 7 watts on 40 meters. This means that you may have to use the rear panel power adjustment to keep the power level the same when you switch bands.

The keyer is the newer Curtis keyer chip and works very well. It is also very nice to have the straight key jack in addition to a jack for paddles. I often like to operate with straight keys and this rig needs no modifications to be able to do this.

The Classic uses an LM-380-based audio amplifier which is better than the LM-386. There is plenty of audio to drive headphones, but the rig doesn't have enough drive for a speaker. This is one of my only complaints. I don't like headphones except during Field Day, and would have liked to install a small speaker. My other complaint is that I find the rig a little on the large size for portable backpacking operations. I like to take a rig and a gel cell on long hikes and would have preferred having a smaller rig. I really like the case for the rig and find it a little too pretty to throw in a backpack, so it would have to wait for a while anyway. There is plenty of space inside the case to add custom accessories, such as a digital display or a speaker (with some additional amplification).

On the air is where the rig really shines. This transceiver is good enough to make quality contacts. Since my first contact on the rig I have continually received good signal reports. This first contact was during a contest, with PL4COM in the Netherlands. He was a 599 with high power and my signal report was a 564 with 4 watts. I next talked to Marty KW1C in Maine. He reported "your new rig doing FB." Next, I had a nice long QSO with Gary WB0DBW/AE in Columbia, Missouri. It was his first contact with his new Extra Class license. We had a nice long QSO. He said the rig sounded great on his end. I have since had many long QSOs, both US and DX, and have worked some contests with the rig. One of the highlights of testing the Classic was having a sked set with Ted VA3TAR. The Classic was Ted's first kit. We arranged to meet on 40 meters. Even though conditions were poor, we had a great conversation. It was exciting to hear what the rig sounds like over the air in actual use. The rig sounded great. I think this attests to both the quality of the kit and its design. I really enjoy operating this rig, especially since it covers my two favorite bands.

### Features: The Oak Hills Classic Dual-Band Transceiver Kit for the 20M and 40M Bands

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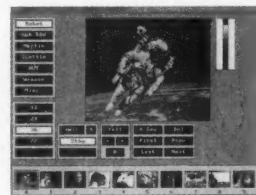
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by Michael Bryce WB8VGE

# S & S Engineering's ARK-4

## A 40 meter transceiver kit.

S &amp; S Engineering

14102 Brown Road

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Telephone: (301) 416-0661; Fax (301) 416-0963

Price Class: \$199.95 kit; \$269.95 assembled and tested.

Some of the buzzwords in today's politically correct world are "smaller," "faster," "cheaper" and "better." Well, that's exactly what S & S Engineering created when they introduced their new ARK-4 40 meter transceiver kit.

The ARK-4 is a fully synthesized QRP transceiver for 40 meters. It's a CW-only rig; there is no SSB on the ARK-4. But, you do get full QSK break-in keying and the 40 meter CW band. It's ideal for the Novice ham, too. In fact, it's one of the few rigs in kit form I'd recommend for a Novice. Thanks to its fully synthesized transmitter, the Novice operator will know exactly where he or she is. This is very important to Novices, who have only a small slice of the 40 meter CW band to begin with.

The ARK-4 comes in a wide variety of configurations. Depending on your budget, you can get just the transmitter or the receiver components with the kit. Later on, as your budget allows, you can add on the goodies until you have a complete 40 meter rig. Why, you can even install a Curtis-based keyer inside your ARK-4. And, if you just can't stand the smell of molten solder, the ARK-4 comes assembled, tuned and tested. Most people will find building the kit the way to go.

If you plan on building the kit, and I hope you do, this is one of the few kits I'd say a beginner can handle. Yes, there are hundreds of parts in the ARK-4. Yes, there is a double-sided plated through-hole PC board. But, you build the ARK-4 in steps, checking each section as you go to make sure you've assembled it correctly. The assembly manual is

quite extensive and offers tips on soldering and proper placement of components, and features several large fold-out sheets. And if that is not enough, provided you assembled the ARK-4 in good faith, you can always get the ARK-4 repaired. There's no reason why a beginner in home-brew should not consider the ARK-4 as their first kit.

### A Look Inside

The ARK-4 is really a departure from most of the QRP rigs I've built. When you slide the rig out of its TNC-style cabinet, you'll notice there are no wires of any kind inside. Yup! You read that correctly: There are no wires inside the ARK-4. Every part mounts on one double-sided PC board. I know, I've always disliked making up my own interconnection wiring harness. No wiring harness means fewer mistakes during assembly.

There are no mounting screws holding the PC board down, either. The PC board slides inside the case. The end caps of the case hold everything together. You can open up and inspect the ARK-4 in a matter of seconds!

The signal path is very much like that of the ARK-4's bigger brother, the ARK-40. There's a slight difference in the way the signal is handled in the IF stage: The IF frequency of the ARK-4 is based on a crystal filter made up of color-burst crystals. This is also the reason why you won't be seeing an ARK-2 or ARK-3.

The synthesizer and a PLL make up the heart of the ARK-4. I won't get into the details

of how they both work together, as this is very clearly explained in the manual. It's must reading for the builder as it makes the operation of the PLL and translation oscillators very clear.

The manual that comes with the ARK-4 is different from what you may have seen in the past. Whatever features you purchase with your ARK-4 will shape the size of the manual. The manual has a pull-apart binding to allow you to add pages of assembly text as you order options for your ARK-4. For example, if you only order the transmitter, that's all the instructions you'll receive. Order the transceiver and you'll get transmitter and receiver text.

Although I did not have the pleasure of building this kit, the kits I have built in the past from S & S Engineering are first class. Only the best prime components are used in the kits; there are no surplus or hamfest special parts used.

### On the Air with the ARK-4

There's not much to do to put the ARK-4 on the air. All you need is a power supply capable of 3 amps, an antenna, and a key. The front panel is nicely laid out, with all the important controls centered. There's the usual on-off volume control, RIT, and transmitter fine-tune control. The options you order for your ARK-4 will determine the amount of control you have over the rig.

Just like the ARK-40, you tune the ARK-4 by push-buttons. However, in the case of the ARK-4 you can use the fine-tune control to put your transmitter exactly where you want it.

The fine-tune control is not the RIT—that's a separate control on the ARK-4. I found the best way for me to tune the rig was to set the frequency control buttons to one location and use the fine-tune control to hunt for stations. When a station answers me, I then use the RIT to center him in the middle of the crystal filter. This is how I used the ARK-4 during Field Day, with very good results. I worked just about everything I could hear while using a center-



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RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
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RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

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RS-4A	• •	3	4	3 1/2 x 6 1/2 x 9	5
RS-5A	• •	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	• •	5	7	3 1/2 x 6 1/2 x 9	9
RS-7B	• •	5	7	4 x 7 1/2 x 10 1/4	10
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RS-12B	• •	9	12	4 x 7 1/2 x 10 1/4	13
RS-20A	• •	16	20	5 x 9 x 10 1/2	18
RS-35A	• •	25	35	5 x 11 x 11	27
RS-50A	• •	37	50	6 x 13 1/2 x 11	46
RS-70A	• •	57	70	6 x 13 1/2 x 12 1/2	48

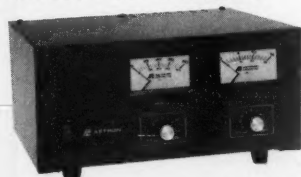
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MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 1/2 x 11	46
RS-70M	57	70	6 x 13 1/2 x 12 1/2	48

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MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC @10VDC @5VDC	@13.8V		
VS-12M	9 5 2	12	4 1/2 x 8 x 9	13
VS-20M	16 9 4	20	5 x 9 x 10 1/2	20
VS-35M	25 15 7	35	5 x 11 x 11	29
VS-50M	37 22 10	50	6 x 13 1/2 x 11	46

### • Variable rack mount power supplies

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
VRM-35M	25	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	50	5 1/4 x 19 x 12 1/2	50

### RS-S SERIES



MODEL RS-12S

### • Built in speaker

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	7	4 x 7 1/2 x 10 1/4	10
RS-10S	• •	7.5	10	4 x 7 1/2 x 10 1/4	12
RS-12S	• •	9	12	4 1/2 x 8 x 9	13
RS-20S	• •	16	20	5 x 9 x 10 1/2	18
SL-11S	• •	7	11	2 1/2 x 7 x 9 1/4	12

fed Zepp at 25 feet. A 24 amp/hr. gelled battery provide the power. After the weekend, the battery seemed untouched.

The ARK-4 does not have enough audio to drive a speaker. It's a headphones-only rig. You can use an amplified speaker if you want. Radio Shack sells an amplified speaker for about \$20. I also found out that the audio output stage of the ARK-4 is very sensitive to the kind of headphones you attach to it. I used a pair of "walking" phones and had so-so results. Later on I changed over to a pair of mono headphones from Radio Shack. These worked better, but I still found the audio to be a bit fuzzy. I measured the impedance of the headphones and discovered they were about 16 ohms for the pair and 32 ohms for each earpiece. I finally hooked up my old 8-ohm Telex 'phones and had much better-sounding audio. I also got a much nicer sidetone when using the telex phones. You may have to play around to find the proper set of headphones for your ARK-4 as well. However, I must add that the rig I was using was one of the first prototypes made by S & S Engineering.

My review unit also came with a built-in audio filter. This filter really improves reception when the QRM is running high, although I found the CW bandwidth just about right for me without the audio filter. I must mention, however, that I never was one for super-tight bandwidth when it comes to my receivers. I like to hear those HW-7 users calling me off

frequency by a kHz or so. You'll never work 'em if you can't hear 'em.

With no antenna connected, you'll notice a high-pitched tone in the audio. The tone all but vanishes when you attach your antenna. I also noticed the sidetone in the background. This is because the sidetone runs continuously and the T/R logic gates it on and off as needed. Again, once you connect an antenna up, you'll not notice the sidetone in the background. I did find that the sidetone changed levels, depending on the type of phones you connect to the ARK-4. In fact, when I attached my Telex phones, I found the sidetone to be way too loud for me. There is no internal sidetone level adjustment, although you can change resistor values to reduce the sidetone level to suit your liking.

The AGC action is very smooth, with no popping or pumping that I could detect. The AGC time constant seems *just about right* for the way I operate CW. You can also listen in on the VEs on SSB without much trouble.

#### The Transmitter

The ARK-4 provides a healthy 3 watts of output on 40 meters. That's more than enough to work the world, without killing your battery pack in the outback. The review rig produced a tad more than 4 watts into a 50-ohm load at 13.8 volts, a bit over 3 watts RF at 12.6 volts.

With full QSK, the ARK-4 provides for, some exciting fun on CW. The relay used for

antenna switching is loud. You can hear the relay clicking in time with your keying. With a slide-on cabinet in place, you won't notice the relay as much.

The ARK-4 is not as robust as its bigger brother, but I'm sure the ARK-4 would hold up quite well in the field. I'm not sure I would take it white-water rafting, but for casual hamming at your campsite it's going to be a hard act to follow. It would be just my luck to stumble upon Elvis and Bigfoot playing cards at a UFO landing, with the Loch Ness monster swimming past in the background, and not have a radio in my backpack!

It's an ideal rig for a hamvacation! Of course, my idea of roughing it is staying at a Holiday Inn while their restaurant is being remodeled. The ARK-4 will fit quite nicely inside a briefcase. Throw in a battery pack and you're on the air from your hotel room. Thanks to the synthesized frequency control, making that schedule with your buddy is no problem.

#### Last Word

I feel the ARK-4 will provide the ham with a better-than-basic QRP transceiver. You get frequency control that is unmatched by anything on the QRP market. That's a real plus on today's crowded bands. Was there a downside to the ARK-4? Yup! I had to send it back! Yes, I do believe that the S & S Engineering ARK-4 is politically correct. It's faster, smaller, cheaper, and better.

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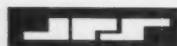
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AR-1 kit .....\$29.95 Matching case set, CAR .....\$14.95

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World's smallest FM wireless mike. Smaller than a sugar cube - including battery and mike. Two sets of SMT parts supplied in audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT tool! FM-5 Micro mike kit .....\$19.95



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FM-4, long range with  
very sensitive audio pickup .....\$14.95  
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Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mv steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 ms to 40 hours. Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit .....\$129.95 CURC Matching case set .....\$14.95  
URC-1WT Fully assembled URC-1 and case .....\$189.95

## FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit .....\$27.95 CSCA Matching case set .....\$14.95  
FR-1 FM receiver kit .....\$24.95 CFR Matching case set for FR-1 .....\$14.95

## LC-METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit .....\$34.95 CLC case set .....\$14.95

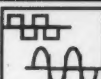
## MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.



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CSMD SMD-1 case .....\$14.95 CMSC MSC-1 case .....\$14.95

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SG-550 Kit .....\$199.95 SG-550WT assembled .....\$269.95

## SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!



Shortwave receiver kit, SR1 .....\$29.95  
Shortwave converter kit, SC1 .....\$27.95  
Matching case set for SR1, CSR .....\$14.95  
Matching case set for SC1, CSC .....\$14.95

## AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1 1/4 miles. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit .....\$29.95

CAM Matching case set .....\$14.95

## SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stability to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.



SCN-1 Scanner converter kit .....\$49.95  
SCN Matching case set .....\$14.95  
SCN-1WT Assembled SCN-1 and case .....\$89.95

## STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool! For a pro look add our matching case set with on-board whip antenna.



FM-10A Stereo transmitter kit .....\$34.95  
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DN-1 Dr. Ni-Cad conditioner/fast charger kit .....\$49.95  
CDN Matching case set .....\$14.95  
DN-1WT Fully assembled Dr. Ni-Cad with case .....\$89.95

## SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-bb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripboard. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.



SG-7 Complete kit .....\$99.95

## STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall—they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistence display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete instructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit .....\$39.95 PH-15 Dual Log bargraph kit .....\$39.95  
PH-16 Dual Semi-Log bargraph kit .....\$39.95 CPH Matching case set .....\$14.95

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## CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit .....\$19.95

## TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit .....\$99.95 CTG Matching case set .....\$14.95  
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Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit .....\$59.95 CCB Matching case set .....\$14.95

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# Kenwood TH-22AT Hand-Held Transceiver

*Meet the latest in little HTs from Kenwood.*

Running a 2 meter handheld used to be a pretty straightforward affair—on/off, volume, a squelch control, and a frequency switch. Of course, when things were synthesized we got a few more buttons, but all in all we could figure it out with a little time to play around. Things got more complex, however, as manufacturers packed even more features into every radio. Of course, that meant more buttons and knobs. Once manufacturers noticed that most hams had above-average consumer electronics skills (after all, we could program our own VCRs), high-tech radios appeared everywhere. This increase in the number of features came at the same time as a change in size—electronics were getting smaller. This shrinking meant that fancier features were coming in smaller and smaller packages. If you remove the battery and antenna from this radio you'll find that it weighs just two ounces more than the instruction manual. Where will it all end?

A grand finale may be the Kenwood TH-22AT. This hand-held radio fits right into the current trend. It's small—about the size of a mobile mike—and it performs a range of neat tricks. At first glance, the radio fills the bill of a general-purpose 2 meter handheld with all the usual specs. It puts out 3 watts with the standard battery pack in the normal mode, uses a dual conversion receiver with 0.16  $\mu$ V sensitivity, and offers 200 mW of audio output. The fun starts beyond the solid basics, where the neat features begin.

## Special Features

One particularly nice function for a radio of this size is a *variable power level*. As we all know, the FCC requires that we always use only the minimum power level that will sustain reliable communications. Most of us detune our handhelds to lower the power when we operate near the repeater location. (You don't??? On the TH-22AT, the power level is keyboard-selectable to high power, which is normally 3 watts and battery dependent; low, which is 1/2 watt; or "economic low," which is 30 milliwatts. Fifty milliwatts will get you around the house, around the hamfest, and even into the repeater if you're close. Of course, for those scofflaws who bypass the FCC regulations, the variable power setting has a side benefit: Using only the minimum power required greatly extends battery life. It's always surprising to see how far you can get on the low power settings!

Once you get over that kilowatt mentality and use the QRP settings, you might want to kick in the *battery saver*. This special function lets the radio sleep if it doesn't hear anything for five seconds. While not usable when scanning, a combination of battery saver and low power operation could wring a lot of use out of a single battery charge. In addition to the battery saver, the radio offers an *automatic power off* feature. The radio shuts itself off after an

hour of no keystrokes.

The TH-22AT offers transmit features that are similar to those found on commercial two-way units. A *time-out timer* is available with periods of 30 seconds all the way up to 900 seconds—for serious one-sided conversations. Time-out timers can be particularly useful if that TNC you bought at the flea market is stuck in PTT—you won't tie up the channel while figuring out what's wrong. A *busy channel lock-out* feature prevents you from doubling with someone—the radio won't transmit if it hears activity on the channel. It would also prevent jamming, but it does need to be enabled by a responsible operator first. The entire transmitter can also be *disabled*—a good feature to have when you loan the handheld to an unlicensed friend. If you don't want to bother with frequency displays or you want to make things easier during emergency drills, the *channel display function* lets the display be configured to show only channel numbers rather than frequencies.

*Memory functions* allow a total of 40 channels—each with its own split, PL tone, dual-tone squelch codes, and more. Non-standard offsets can be programmed in addition to the usual  $\pm 600$ . A *call channel* can also be entered—easily recalled with the tap of a button, it's also used in some scan functions. The call channel will probably be used to store your "home" repeater. The *DTMF keypad* allows telephone patch or repeater controller operation with five memory locations for storing frequently used calls. Up to 15 digits may be stored in a single memory location.

The TH-22AT offers a variety of *subaudible tone* and *paging functions*. The subaudible CTCSS functions are usable only with the optional TSU-8 decoder. They are similar to what one would find in the commercial market. On transmit, using one of the 38 standard CTCSS, or "PL," tones allows the operator to access tone-operated repeaters. On the receive side, however, the TH-22AT lets you enable *tone-coded squelch*. This is a feature that allows the receiver to remain muted until it hears the proper tone on the



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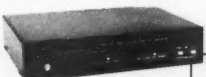
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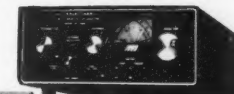


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carrier. It is used mainly in shared repeater operations in the commercial world so that you don't have to listen to other fleets on the repeater. It could be useful in ham radio as a way to avoid listening to anyone until your buddy calls with the right tone. Either of the PL functions is easily enabled from the keypad on a per-channel basis.

The Kenwood also offers a *dual-tone squelch system*. This is a receive-only function that uses a three-digit DTMF code to unmute the receiver. This feature provides a total of 1,000 discrete addresses, and it supports selective paging of specific subgroups. There is another advantage of DTSS over CTCSS for selective paging—DTMF tones will be easily passed over a repeater. CTCSS tones may or may not be retransmitted.

Taking yet another step, Kenwood offers *page operation*. This is similar to *dual-tone squelch system*, but with "Caller ID" added. When paged, the DTMF code of the calling station will appear on the display. In other words, if you're not right at the radio when the page comes in, the display will tell you who paged you and whether it was an individual or a group call. Page operation allows eight codes to be stored for ease of use—two for the system use and six for your convenience. With some imagination, a local repeater group can work out a series of emergency plans that would allow different groups and subgroups to be paged at will. Since the page mode uses DTMF tones, the system supports existing equipment, and also radios other than Kenwood's. Hams will use this feature primarily for selective calling between buddies. It's a great feature to have built right into the handheld.

Any of the above features can be used in conjunction with *tone alert*, which adds a beep tone when the radio receives any of the above tone sequences. Once the unit is paged, the radio starts beeping and a 100-minute timer starts. The timer resets itself after 100 minutes or each time a new page is received.

### Scan Functions

Perhaps one of the most used features of a handheld in this class is the *Scan function*. The receiver in the TH-22AT covers 136 to 174 MHz. Most hams will probably have a police frequency or two plugged into a memory slot. (No, you can't transmit on 155.250, even if you do know something relevant to the conversation.) As per most features on this versatile radio, there are several options to choose between. To begin with, there are four basic types of scan:

*Memory scan* scans those channels in the memory list that you've designated as scan channels.

*VFO scan* scans VFO limits and lets you easily change directions with the channel select control.

*Call/VFO scan* lets you monitor the call channel plus any single VFO frequency.

*Call/memory scan* lets you monitor the call channel plus the last memory channel used.

The *call channel* is usually your "home" repeater, so either of the last two modes would be useful during a public service event. You could monitor the event frequency and the local repeater—or perhaps the event frequency and the local police department—at the touch of a button. Once you have determined the type of scan you need, you also need to select either time-operated or carrier-operated scan. Time-operated scan puts the radio in the "channel surfing" mode: scan along until you hear a QSO, listen, wait five seconds, scan some more, listen, wait five seconds, and so on. Five seconds may be too short to determine if you have any interest in a QSO, but this time length is fixed.

Alternatively, carrier-operated scan is the basic home scanner mode: Scan along until you hear a QSO and listen to it until they finish talking, even if this means listening to it forever. Both systems have their downsides, but the system you choose will depend on the personality of your local radio universe.

### Startup and Operation

One of the classic tests of a product of this type is to see how far the operator can get without resorting to the manual. In the case of the feature-filled TH-22AT, the answer is—not all that far. Most of the obvious functions are easily accessible: The radio can be easily put on channel for a QSO. But some of the more advanced features are stumbers.

The reason for the difficulty is mainly that Kenwood decided to use very few buttons to perform a lot of tasks. Not counting the usual buttons like the DTMF pad and PTT button, the radio uses just six buttons to perform all of the other features. With just three different ways to push a button, the Kenwood engineers squeezed quite a few functions out of their options. The three possible modes for a button on a radio are: 1) just push it; 2) push it for an extended time; and 3) push it in combination with another button. The TH-22AT makes use of all three modes.

The display is also somewhat challenging. It doesn't provide much direction to the user when entering some of these functions. For example, say you'd like to lock out a member of the scan list. This would be handy if you had your normal scan list in the radio, but it kept stopping on these same two guys on the local repeater. The scan lock-out feature lets you leave the channel in its normal memory location and mark it as a channel to be skipped during the scan process. (You know, sort of like hitting LOCKOUT on your scanner.) On the TH-22AT, you simply: 1) tap the MR/LOCK button; 2) hold the F button down for more than one second; and 3) tap the LAMP button. Voilà! The channel is locked out. A small star pops up on the display under any locked out channels. The only problem with this is that neither the MR/LOCK (memory recall/keyboard lock), nor the F (function), nor the LAMP (display backlight) buttons are labeled in any manner that would hint at scan functions, let alone

scan lock out. The solution is to practice and use the radio. You can memorize all of the keystrokes, or carry the five-page "Quick Reference Guide" found in the back of the manual. It seems like only a matter of time before some aftermarket vendor will start selling tiny plastic keyboard overlays, just like you get for WordPerfect, so we can figure out how to use our radios without lugging the book along.

In addition to the basic day-to-day features, the Kenwood TH-22AT also has a separate menu system accessible through a "hold the button while turning on the radio" mode. This allows access to the lesser-used functions, such as the *time-out-timer delay*, *transmit inhibit*, and *battery saver*. Once again, you may need the book. All things considered, the user is much better off having access to all of the functions available through these tricky key combinations, compared with no access at all. Could it be we're just spoiled by being able to hit the F1 key for context-sensitive help whenever we feel like it?

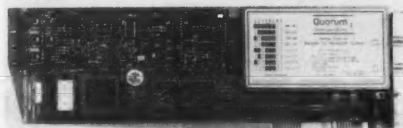
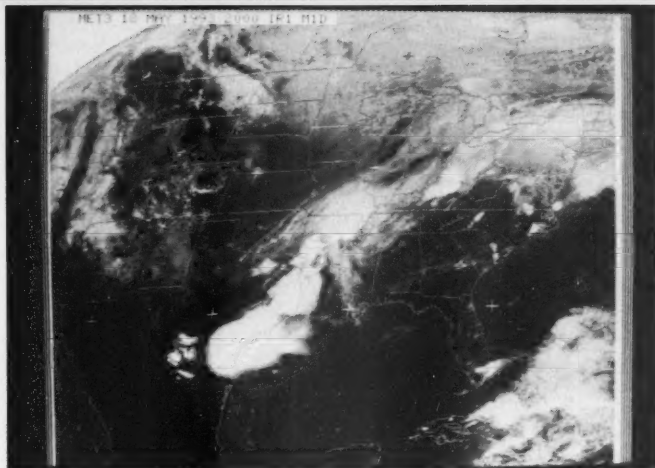
### The Manual

The operator's manual, even though loaded with button combinations, is actually very well written. Everything is very clear and concise, and there are several sections devoted to ensuring a successful session with the radio—especially for the inexperienced operator. One section, "Your First QSO," gives just the basic steps necessary to fire the rig up enough to kerchunk the local repeater. A "Packet Operation" section gives hints on TNC hookup. The "Troubleshooting" section offers some help for possible problems. Not just the usual "check the battery if it doesn't work" type of advice, the list of symptoms consists of possible ways that the operator might inadvertently confuse the radio. For instance, you're in the PAGE mode, or the CTCSS mode, and you can't hear anything. You've accidentally locked the keyboard and none of the buttons work. The list of symptoms addresses both common and uncommon problems, and their solutions.

The manual is suitable for all levels of users, and seems to be written with the beginner in mind. At some points the explicit instructions can be amusing: "If an abnormal odor or smoke is detected coming from the transceiver, turn OFF the power immediately. Contact a KENWOOD service station or your dealer." Good advice. Or how about "Functions requiring the keypad cannot be used if no keypad is installed." Most of the manual is not quite this carefully worded, and most necessary information is easy to locate with the very complete table of contents.

The Kenwood TH-22AT fills a very important niche. Small enough to be easily carried in a coat pocket, the unit has all the power and more features than many much larger units. Use it often enough to get used to all the different commands—or carry a handy cheat-sheet in your wallet—and the Kenwood will make a very talented and versatile day-to-day companion.

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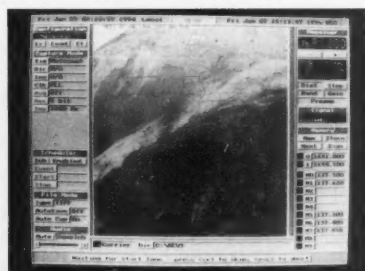
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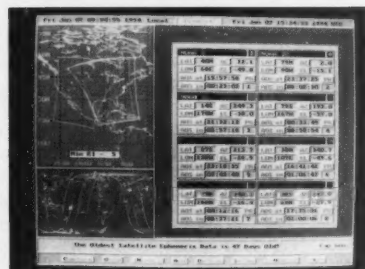
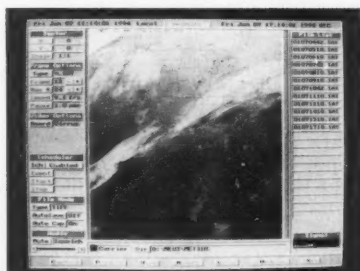
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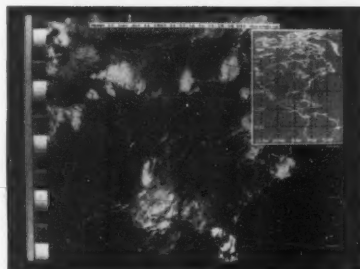


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CIRCLE 257 ON READER SERVICE CARD

by Dave Martin W6KOW

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# Ameritron ALS-500M Solid-State Mobile HF Amplifier

*The long-awaited linear lives up to its promotion.*

Kicking and screaming—after 40 years of hamming while managing to avoid owning an HF amplifier—I recently bought an Ameritron ALS-500M linear designed for mobile . . . and I'm delighted with the purchase. Details follow, but first, for hams with similar leanings, the sequence that led me to the ALS-500M might be worth revealing.

## I Like Low Power

Maybe it's the thought of sticking it to the power conglomerates or of getting the most kick for the buck, but I'm the guy whose first solo was in a glider, not an airplane . . . who bought a sailboat, not a power boat, when living in a yachting paradise . . . and who designed a little voltage-divider network so my Icom 735 could get *under* the 8-watt power control minimum for less-than-5-watts QRP.

But circumstances change. About a year ago I joined a net scattered all over the country, and my linear-less shack and mobile rig condemned my 100-watt signal to the bottom of the heap; everyone else had power available to combat the latest decline of HF propagation that we can blame on the nadir of the current sunspot cycle.

Everybody recommends maximizing antennas before buying an amplifier, and I did. But there's not much chance of significant

gain from a vertical whip on a small car. And my tiny California city lot—blessed with power lines on two sides and many nearby neighbors—pretty well precludes adding to the HF antenna farm, which includes a three-band, three-element yagi at 40 feet; a seven-band vertical on the house; and an inverted V fed with ladder wire.

Because of my long commute, a mobile amplifier seemed most desirable, but the home QTH signal could use a boost too. What to do? The idea came from a friend who travels between homes in Southern California and Montana: He runs a mobile linear in the car and uses the same box in his summer house, powered with a hefty 12V marine battery and an automatic battery charger.

## The Order

After months of vacillating (and checking on the back-order status of the Ameritron ALS-500M at various ham stores), I ordered from the outfit with the fewest units on back-order. No strings were pulled; no mention was made of writing a review on this unit. Less than a week later, a large box appeared on the front stoop, and a quick trip to a nearby automotive store for a 108-ampere/hour, deep-discharge marine battery and a 10-amp automatic charger had the new rig on the air that day.

## Initial Reports

The results were gratifying: First contact was with a station in Florida on 20 meters. He reported a barely readable S2 signal barefoot . . . and a plainly legible S7 with the Ameritron cooking. I know the numbers defy the laws of physics (indicating his S-meter calibration is off); using 50 watts barefoot and assuming peaks of 500 watts powered up, that's 10 dB of gain, which is just under two S-units, not five. But the importance is *readability*, which improved from *marginal to easily copyable*. QSOs over the next few days—while I waited for a second power plug from Ameritron to finish the mobile setup—confirmed a 2-S-unit improvement and a lot more punch through the reluctant ionosphere and QRM. That's why people spend hundreds of dollars on these things.

## The Technical Side

The Ameritron ALS-500M is a compact (3.75" x 9" x 15"), light (7.5 pounds), solid-state HF linear with continuous no-tune coverage from 1.5 to 22 MHz (and to 30 MHz with presentation of an appropriate license and purchase of the \$29.95 extender kit). Four 2SC2878 power transistors provide output of 500 watts PEP on SSB and 400 watts on CW. My measurements indicated full peak power was available with 60 watts of drive. Ameritron warns not to drive the ALS-500M with more than 100 watts continuously. DC power required for full output is 13.8V at 80 amperes on peaks. More on this shortly.

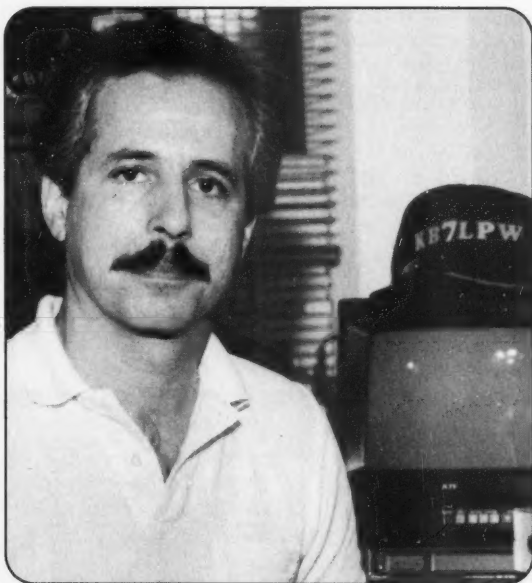
Load fault protection disables the amplifier if too much power is reflected from an antenna with high SWR (more than 2:1). An LED lights if this occurs. So far, I am operating without the benefit of a tuner in the antenna circuits, both mobile and fixed, and the Load Fault LED has remained off.

Thermal overload also disables the amplifier, and an LED warns when this happens. The unit operates cool and silently; a heat-triggered 3" fan that sucks air through a 6" x



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For sponsorship information contact Ron Cohen at 602-241-0482.

The voltage drop to 12 volts and resulting power reduction in my setup do not appear detrimental to the effectiveness of Ameritron's solid-state ALS-500M mobile amplifier. Everyone reports excellent audio and greatly improved readability in today's often-marginal conditions. That's what counts.

CIRCLE 49 ON READER SERVICE CARD

# MFJ WINDOWS SOFTWARE

MFJ station automation software finds DX, tunes your rig and does your logging

With a few "point and clicks" of your mouse, this powerful MFJ WINDOWS software helps you... find and identify on-the-air DX you need from PacketCluster networks... search your log to see if you've worked him before... automatically set up and tune your transceiver... and work him with pre-stored messages.

And while you're working him, you can... log him... print his QSL card... search and update your awards and contest files.

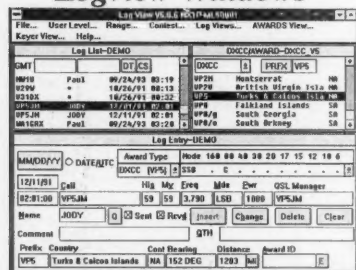
Logview Windows™, Packet Windows™ and Rig Windows™ are powerful ham radio automation software programs that makes operating fun, DXing competitive and not-so-fun details effortless.

You can use them together as a fully integrated package that unifies your transceiver, packet TNC and logging functions into a fully automated station.

Or you can use them individually as stand alone programs and add other modules as you need them.

Here's an overview of each program...

## Logview Windows™



### Logview Windows™ screen

Logview Windows™ is a live real time computerized logbook that gives you instant access to your data.

When you enter a call sign, Logview Windows™ automatically checks to see if you've worked him... if you need him for DXCC or an award... calculates distance and bearing so you know where to point your beam... for contests it checks for dupes, tells you where you need to make a QSO and its score.

You can scroll through your log in familiar logbook format in either call sign order or date and time order.

For each contact you make, Logview Windows™ lets you simultaneously update and keep up with dozens of awards such as DXCC, WAZ, OBLAST and WPX. You can attach award identifiers to QSOs for tracking awards.

The Contest Mode gives you fast dup checking and automatic time/serial number stamp. It tells you how many contacts per hour you're making, time past since your last QSO, point score, multiplier score and total score.

Even as you're making your contact, you can be printing a QSL card.

You can choose who to send QSL cards to based on QSOs not confirmed or not sent.

You can print cards or labels in standard format or customized them to suit you. You can print in time or bureau order.

Hundreds of QSO and award reports can be generated. Data from CT and other popular logging programs can be imported.

You can "click on" the built-in keyboard keyer and let Logview Windows™ help you make QSOs with 8 pre-stored CW messages.

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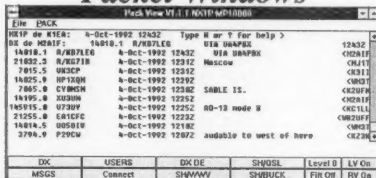
\$109.95 each

You can automatically add the active call to selected messages -- such as a routine exchange of RST, QTH and name.

You can use beginner levels to get going quickly. When you're ready for more advanced features you can use the expert levels.

MFJ-1681 Logview Windows™, \$69.95.

## Packet Windows™



### Packet Windows™ screen

Using Packet Windows™ and your TNC to access DX PacketCluster™, you can display a list of current on-the-air DX stations.

You can scroll through these DX stations and select one with your mouse. Your rig is automatically tuned through Rig Windows™ and your logbook is automatically set up through Logview Windows™ to log your rare DX -- all you have to do is work 'em.

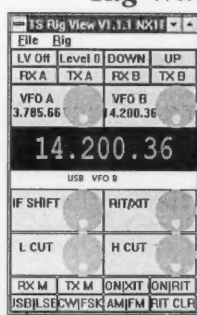
You can select only the DX you need. When they occur, an alarm sounds or you can have their call sent in CW -- you'll know about band openings even if you're in the next room.

For true "hands off" operation, turn on AutoSpot™. When DX you need appears, your rig automatically tunes to his frequency and your logbook automatically sets up to log.

Operating your TNC or PacketCluster™ can be as easy as "point and click" when you use Macro buttons for commonly used commands.

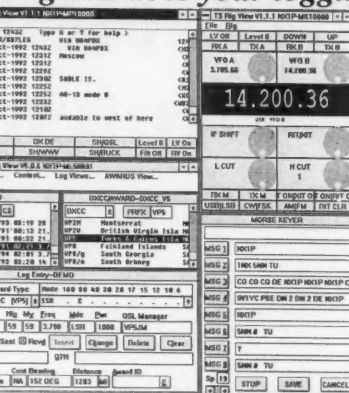
MFJ-1682 Packet Windows™, \$29.95.

## Rig Windows™



### Rig Windows™ screen

Rig Windows™ gives you full computerized control of your transceiver. Data from Packet Windows™ automatically tunes your transceiver to the DX station you want. Frequency and mode is sent to Logview Windows™ for automatic logging. Unique mouse operated tuning



Typical real time logging, packet and rig control windows

knobs make tuning as natural as your real tuning knob. You get fine and coarse tuning, separate knobs for VFO A and VFO B plus, frequency and rig status displays.

With 48 command macro buttons, you can define and chain them to create complex transceiver control by clicking your mouse.

Separate Rig Windows™ programs are available for Kenwood, Yaesu and ICOM radios. Each program is customized to make use of features unique to that manufacturer.

For Rig Windows™, order MFJ-1683K for Kenwood, MFJ-1683Y for Yaesu and MFJ-1683I for ICOM, \$29.95 each.

Requires MFJ-5383K/Y/I transceiver-to-computer interface cable below.

## Transceiver-to-Computer Interface Cable has RS-232 serial interface built-in!

MFJ-5383K (Kenwood)  
MFJ-5383Y (Yaesu)  
MFJ-5383I (Icom)  
\$49.95 each

Convenient pre-wired Transceiver-to-Computer interface cable has RS-232 serial interface built-in!

Each cable has connectors wired for your transceiver and IBM compatible computer.

Just plug a pre-wired cable into your transceiver and computer serial ports and you're ready for computerized control of your rig through Rig Windows™.

MFJ-5383K for Kenwood, MFJ-5383Y for Yaesu, MFJ-5383I for ICOM, \$49.95 each.

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# Stretched Vertical Gain Antenna for 6 Meters

*Here's a way to dramatically improve your 50 MHz operating capabilities.*

by John Sehring WB2EQG

At one time I lived in a rather deep valley and wanted to increase my operating range on 6m FM simplex (52.525 MHz), as well as use repeaters scattered over a 100-mile radius. So I was looking for an omnidirectional, vertically polarized antenna with as much gain as possible.

Because of the surrounding terrain, I could barely work stations only 20 miles away in some directions when using a 1/4-wavelength ground-plane antenna mounted about 25 feet off the ground. Many signals from not very far away were weak, had lots of QSB, and sometimes sounded distorted on FM.

The QSB and signal distortion was due to signals coming in from a variety of directions (multipath propagation) because of knife edge diffraction and various kinds of reflections and scattering over the surrounding hills.[1]

## Omnidirectional Gain

With a unidirectional antenna such as a yagi, gain is achieved by concentrating the antenna's main lobe in both the azimuth (horizontal) and elevation (vertical) axes. However with an omnidirectional antenna, we can't compress the beamwidth in azimuth because we want to keep it non-directional.

The only way to achieve gain in this case is to narrow the antenna's pattern in elevation (the vertical direction). The lobe is then (usually) concentrated at as low an elevation angle as possible. The resulting radiation pattern looks like a squashed doughnut.

However, this would place the maximum gain lobe at the horizon (0 degree elevation) which would run it right into the hills around my QTH. Looking at the elevated visible horizon at my location, I wondered how much this kind of gain would help. But, I decided to give it a try.

So I put together a 1/2-wavelength vertical antenna to replace the 1/4-

wavelength ground-plane I'd been using. I used a discarded 11m Citizen's Band 1/2-wavelength vertical antenna for materials (there are a lot of these around not being used!), including the insulated base and mounting bracket. Since the end of a 1/2-wavelength dipole is "hot" (a point of high impedance and therefore high RF voltage), it needs to be well insulated from ground. I installed four 1/4-wavelength radials (each 51 inches long and 1/2" in diameter) at the base of the antenna underneath the matching section.

## Matching Network

To end-feed the antenna I used a large, single-turn, tapped LC matching network at its bottom end (see Figure 1).[2,3] This network transforms the high impedance of the dipole's end down to 52 ohms.

It also puts the antenna at DC ground. This is electrically safer, and it eliminates precipitation static, which can be very strong (from blowing dust or snow, for example). These particles sometimes have an electrical charge. When they hit an antenna, they are discharged. If the element is not DC-grounded (as with a 1/4-wavelength ground-plane or a center-fed 1/2 wavelength antenna), the discharge must flow through the input circuit of the receiver, thus generating noise.

The loop (L) and tap are made from soft, eight-gauge aluminum ground wire, which is easy to form. The loop is about 7" in diameter, giving an inductance of around 0.6  $\mu$ H. For the capacitor (C) I used a short piece of RG-58 coaxial cable. This cable has a capacitance of about 28 pF per foot. I cut it a bit at a time to get the right amount of capacitance. It required about five inches of cable (about 12 pF) to resonate the network at 52.525 MHz.

You could use a fixed or variable capacitor instead—but watch the voltage rating! The impedance at the end of a dipole is several thousand ohms, which means high RF voltage. Additional stray capacitance is supplied by the base bracket.

Rule of thumb: The inductance of the coil should be chosen to resonate the network at the operating frequency with a capacitor whose value (in pF) is from two to four times the operating wavelength in meters. This gives a sufficient "high-C" (low loss) network.

I played with the length of the antenna (about 108 inches) to get it to resonance. Then both the network's capacitance and the position of the tap were adjusted for

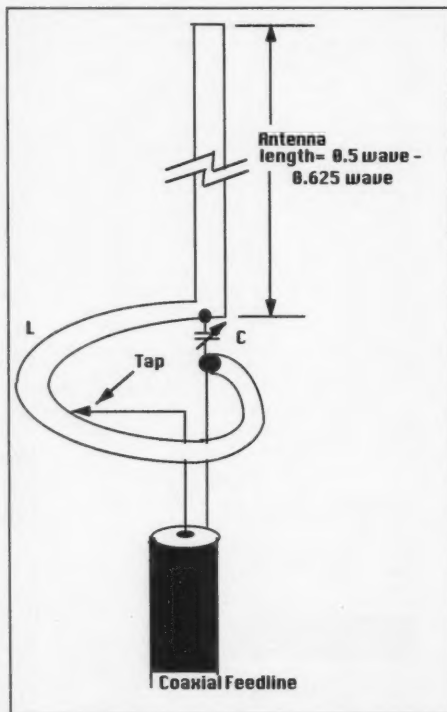


Figure 1. LC matching network for the Stretched Vertical Gain Antenna.

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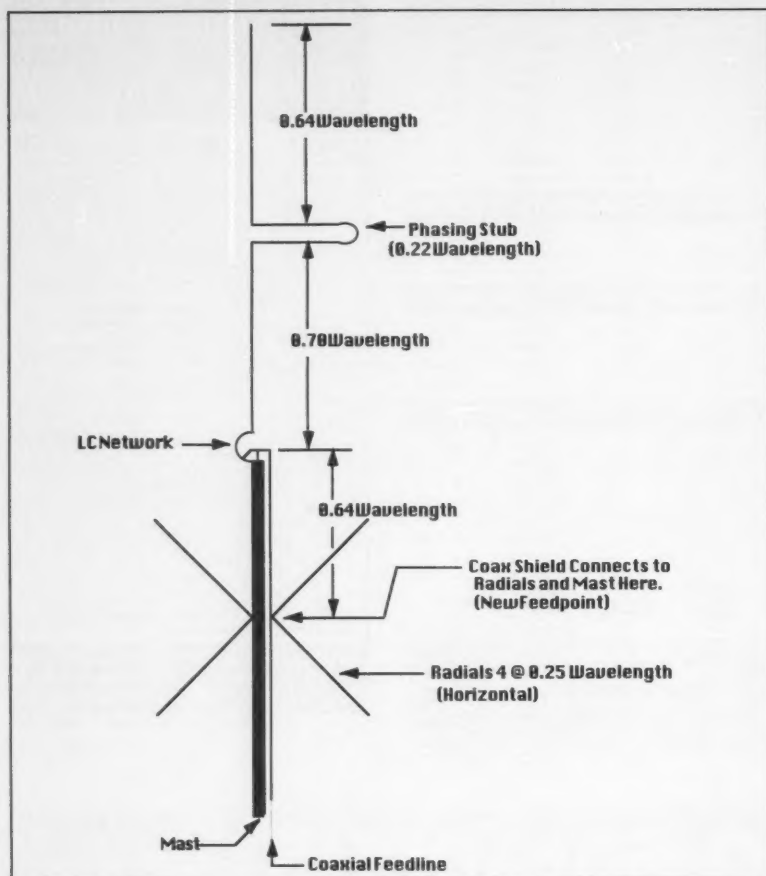
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**Figure 2. A look at the Stretched Vertical Gain Antenna's overall design.**

the best match to the 52 ohm feedline. There is interaction among the antenna length and the network adjustments. I could achieve very nearly a 1:1 standing-wave ratio. A good match is important as feedline losses on 6m are more strongly affected by SWR

than at lower frequencies. This is because feedline has more loss to begin with at higher frequencies.

The longer antenna produced definite increases in signal strength and quality as a 1/4-wavelength ground-plane antenna actually shows a slight loss relative to a dipole.

## Longer Yet

I next lengthened the antenna to 0.64 wavelength, about 139 inches long. This length gives the maximum theoretical gain for a single element working against its electrical image (the image needs to be provided by a ground-plane—the earth, a metallic surface, counterpoise, or radial system).

I used the same matching network, with adjustments. I saw slight further improvements in signal strength. Emboldened by success, I went for broke. What about using a pair of 0.64-wavelength sections in a two-element, vertical collinear array, like an extended double Zepp antenna?

Now, I don't claim originality

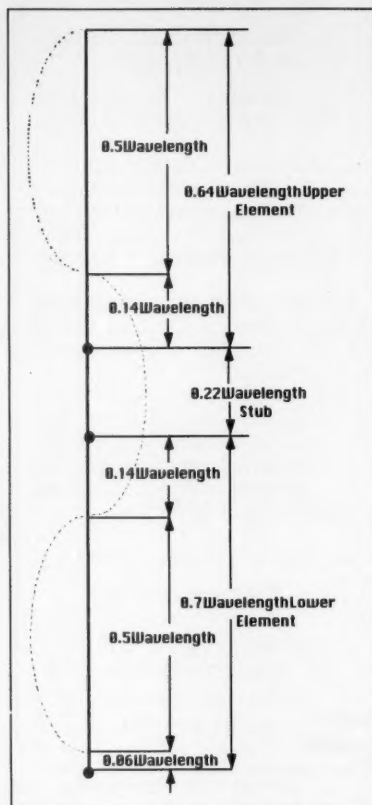


Figure 3. Electrical schematic and current distribution of the Stretched Vertical Gain Antenna

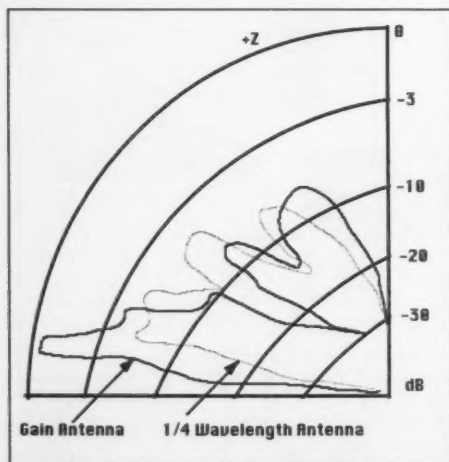
for the design of the final version of this antenna. The inspiration came from the Cushcraft Ringo Ranger series of vertical VHF antennas.[4] My plan was simply to scale up the dimensions of this design from the 2m to the 6m band. The basic design consists of two roughly five-eighth wavelength sections in a vertical collinear array, separated by a phasing stub, and bottom-fed (see Figure 2) at the LC matching section.

When a stub of the correct length is placed between the upper and lower elements, it provides just the right amount of electrical delay (phase shift) to keep element currents in the correct relationships for maximum gain. Also, if the stub and element lengths are correct for each other, the current in the stub will be balanced and it will not radiate. See Figure 3 for the current distribution on the antenna.

### Feedline Decoupling

Interaction between the antenna and the coaxial feedline is a frequent problem with end-fed vertical antennas. Unwanted current is caused to flow on the *outside* of the shield of the coaxial cable.

Coaxial cable is shielded and does not normally radiate. When it is correctly operated as a feedline, there is *no* current flow on the outside of the shield. That's why it



**Figure 4. Elevation pattern comparison (see text).**

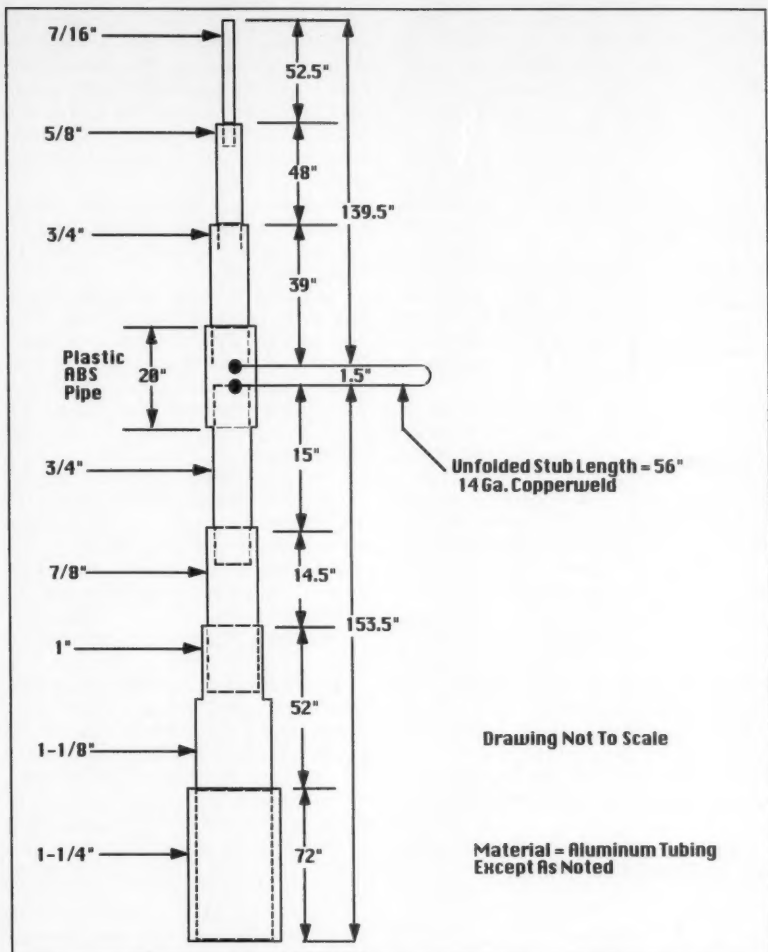


Figure 5. Sizes of aluminum tubing used in construction. Note that the stub connects through a section of white PVC pipe.

doesn't radiate! All of the current is then properly confined to the inside of the cable. It flows on the *inside* surface of the shield and in the center conductor, where it can't radiate. Currents on the inside and outside surfaces of the coaxial cable's shield can be different.

The extra current on the outside of the shield produces radiation from the feedline, which is unpredictable in effect due to differences in feedline installation (length and orientation). The strength and phase of this current flow is also unknown. Since current flow causes radiation, the outside of the coaxial cable will then radiate. This feedline radiation can interact with the wanted radiation of an antenna and spoil its pattern. A lot of work has been done on this effect.[5,6,7,8,9,10,11,12,13]

Some of the outside of shield current is induced by the antenna's own radiation field via mutual coupling between itself and the feedline. The amount of coupling in our case (vertical antenna and feedline oriented collinearly, end-to-end) is considerably less than it would be if, for example, the antenna

and feedline were parallel and broadside to each other.[14,15]

Another, stronger, source of this induced current is the connection at the feed point. See the Appendix for details of how this happens.

This outside of shield current has nothing to do with the presence or type of matching network used. It is *not* due to current "leaking" through the coaxial shield.

So, to help isolate the feedline from the antenna and reduce outside shield current, I wrapped the coaxial cable into a six-turn air core RF choke about 6" in diameter, just below the coaxial connector at the base of the antenna. Additional decoupling can be had by slipping suitable (lossy at 50 MHz) ferrite beads onto the outside of the coaxial cable to form a choke.[16]

#### Improvements

Changes to the antenna's original design by the manufacturer have improved feedline decoupling in the Ringo Ranger II. This is accomplished by installing a decoupling section (an extra piece of coaxial cable) be-

tween the original feed point and four 1/4-wavelength radials which are now located 0.64 wavelength below the antenna's feed point. See Figure 2 for the overall design.

I connected the radials (which are connected to the mast) to the shield of the coaxial feedline at that point using a double female coaxial connector adapter (make sure to weatherproof these connections). A 144" (about 0.64-wavelength) piece of coaxial cable was then run up, using TV-type mast standoff insulators to dress it away from the mast, to the original feed point. Do not tape this new section of coaxial to the mast. The coaxial choke from before was placed just below the radials (the new feed point) for added isolation.

#### Refinements

Originally, I had simply scaled up all the dimensions of the Ringo Ranger from 2m to 6m. It worked well, but I wondered if it was truly optimum. After a<sup>1</sup>, I had ignored the effects of length-to-thickness ratios of the elements—this can throw a design off, especially at VHF.

I used MININEC[17] to model and optimize the antenna for maximum gain while holding down the strength of the sidelobes. These sidelobes (normal for use of a 0.64-wavelength element—it's the price of more gain) point upward at the sky, a source of cosmic noise on 6m. In fact, cosmic noise is the limiting factor in reception (it sets the ultimate noise floor) on 6m.[18]

I altered the element lengths slightly to find the best design. While the final gain was just slightly less, the sidelobe levels were reduced even more. In other words, I optimized the antenna's gain-to-noise ratio. Surprisingly, the new dimensions were only a few percent different.

Figure 4 shows the elevation pattern of the final design along with a 1/4-wavelength groundplane antenna for comparison. Only the lowest elevation lobe is useful for communication purposes. The other lobes only point at the sky and raise the noise level. Note that the gain antenna has the strongest lobe near the horizon (most gain for signals) and the weakest lobes point at the sky giving least noise pickup.

As a reality check, in free space, a pair of 1/2-wavelength, end-to-end, collinear dipoles should give 1.9 dB more gain than a single dipole. Stretching them to 0.64 wavelength each should yield an additional 1.1 dB, for a total of about 3 dB (= 5.1 dBi) of theoretical gain over a dipole.[19]

Computed gain of the antenna over real ground is about 4 dB (7.5 dBi) more, and it hears about 2.3 dB less sky noise than a 1/4-wavelength ground-plane. This gives a 6.3 dB improvement in gain-to-noise ratio over a ground-plane.

The discrepancy in computed gain (7.5 vs. 5.1 dBi) is due to ground reinforcement effects and possible computer modeling errors. As always, we need to take both theoretical and computer model predictions with a grain of salt!

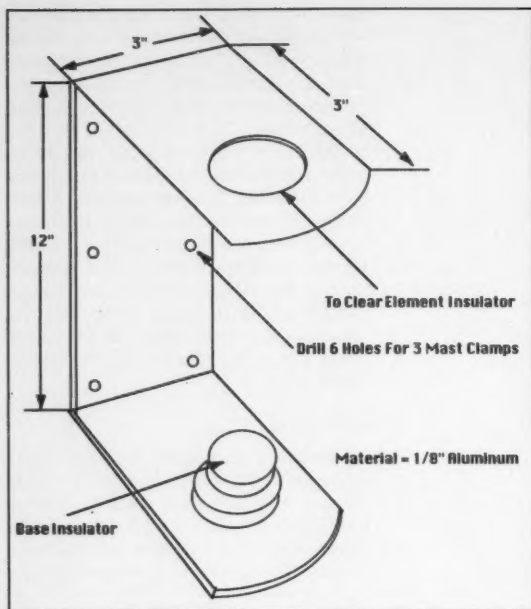


Figure 6. Base mounting bracket.

#### Mechanicals

The major consideration was now mechanical: How do you build a sufficiently strong, free-standing, 24-foot-tall vertical antenna? My first design was fine in calm weather, but it was too flexible and winds

tubing runs all the way to the bottom of the antenna inside the shorter 1-1/4" section. The individual piece lengths of tubing are not too critical. In my case, they are the result of what was in the junk box. The total element lengths need to be correct, however.

whipped it around greatly. The tip of the antenna was pulled over to almost 90 degrees by very strong winds, but it didn't break!

Even small amounts of antenna bending produced a lot of QSB on signals. This was because the main lobe, now quite narrow in elevation (like a pancake), was being pulled above and below the horizon as the antenna was bending.

The final sizing of aluminum tubing (mostly type 6061-T6) which cured the bending problem is shown in Figure 5. The two bottom pieces of tubing with the largest diameters make a double wall in the bottom section for added stiffness. The longer 1-1/8" diameter section of

Note the piece of white PVC plastic piping (3/4" inside diameter) used as an insulator for the phasing stub. The stub is made from 14-gauge Copperweld (copper-plated, steel core) antenna wire. The stub is then stiff, light, and self-supporting. It is mechanically and electrically attached to the metal tubing sections inside the PVC section, using small aluminum screws and nuts running through a hole the PVC and the tubing inside. Use the cold water type of PVC—it's thicker and stronger.

Connection between tubing sections is made in the following way: The ends of the outer tubes are slit with a hacksaw for about 2", and a stainless-steel worm drive hose clamp is tightened over it. A small aluminum screw and nut may also be run through each connection once the final lengths are set.

I used electricians' "compound for aluminum conduit joints" (for example Noalox) at all tubing connections to reduce corrosion and seizing, and enhance conductivity. The paste was still in place after 10 years of exposure. (I recommend this paste for use with all aluminum antennas.) All joints were weather-sealed with silicone-based bathtub caulk.

Figure 6 shows the insulated base mounting bracket rescued from a 1/2-wavelength 11m antenna. (The Cushcraft R4 vertical HF antenna uses the same kind of base bracket.) The large upper hole of the bracket contains a plastic insulating ring (not shown) in which the antenna is laterally supported but insulated from the bracket. This ring could be made from a short piece of PVC tubing slipped over the bottom end of the element.

The two-step plastic insulating base (which looks like a two-layer cake) shown at the bottom of the bracket supports the lower end of the antenna vertically and laterally. An aluminum bolt and nut is run through the bottom end of the antenna and the upper part of the insulating base. Three muffler or antenna clamps secure the bracket to the mast.

The antenna is strong and light, and has survived for 10 years with no noticeable mechanical or electrical degradation.

#### On The Air

Results using the final design were gratifying. Ground-wave range increased markedly over the ground-plane antenna, which I kept up for comparison purposes. Signals not copyable on the ground-plane antenna are Q5 on the gain antenna.

On-the-air improvements were considerably greater than would be suggested by gain increase alone. Our antenna "hears" well not only because it has gain but because it ignores sky noise, thus improving the gain-to-noise ratio. The FM threshold effect (the non-linear relationship between the FM signal-to-noise ratio and carrier-to-noise ratio) magnifies the effect of this. [20]

#### Footnotes:

[1] I have seen this effect on reception of VHF TV signals in remote mountainous regions. A

#### Current Flow on the Outside of Coaxial Feedline

To see why this happens, let's look at the currents at the bottom end of a vertical antenna, using the matching network described in Figure 1. See Figure 7 for the various current flows.

$I_A$  is the antenna current at the bottom end of the antenna. It flows into the top of the coil. Current  $I_L$  flows from the coil tap into the center conductor of the coaxial line. A current of equal strength to  $I_L$  but opposite in direction,  $-I_L$ , flows on the inside surface of coaxial shield. Current  $I_B$  flows out the bottom end of the coil.  $I_S$  flows on the outside of the coaxial shield.

Using Kirchoff's current law (the algebraic sum of currents flowing into and out of a junction must equal zero), we get two equations:

$$I_A = I_L + I_B$$

and

$$I_S = I_L + I_B$$

We can solve the first equation for  $I_B$  and substitute it into the second.

The result is that  $I_S$  is equal to  $I_A$ . In other words, the amount of current that flows on the outside of the coaxial shield is the same as the amount of current which flows at the bottom end of the antenna. (This analysis is from Endnote 11.)

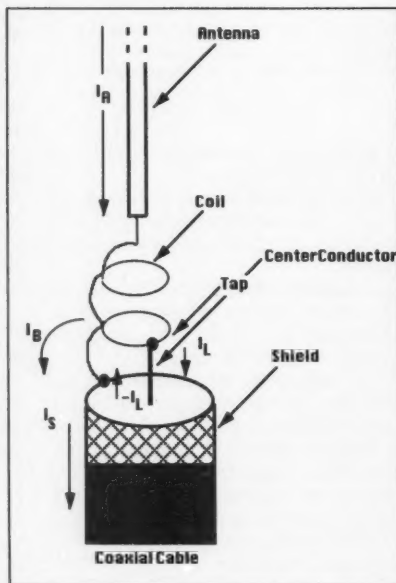


Figure 7. Current flows at the bottom end of a vertical antenna (see text).

highly directional antenna's beamwidth in azimuth appears to become very broad because the diffracted and scattered signal no longer arrives from only one direction.

[2] Orr, W., "Gamma-Loop-Fed Vertical Dipole," *Ham Radio*, May 1972. References 2, 3, and the reference of this footnote contain an inductance nomograph.

The inductance of a single turn coil is approximately:

$$L = 0.016D(2.3\log_{10}(8D/d) - 2)$$

where L is the inductance ( $\mu$ H) of the coil, D is the coil diameter (inches) and d is the wire diameter (inches). (Formula from Terman, *Radio Engineer's Handbook*, 1st Edition, McGraw-Hill, New York, 1943, p. 52).

[3] Orr, W. and S. Cowan, *The Radio Amateur Antenna Handbook*, Radio Publications, Inc., 1978, p. 101.

[4] Manufactured by Cushcraft Corporation, Manchester, NH 03108.

[5] Knaack, R., "Detuning Sleeve for the Ringo Ranger," *QST*, May 1983.

[6] Orr, W., "More About Radials," *Ham Radio*, November 1984. Discusses the use of radials

longer than 1/4 wavelength.

[7] Meyer, P., "The Truth About 5/8-Wavelength Vertical Antennas," *Ham Radio*, May 1974.

[8] Aurik, L., "Equipment Review: The ASEA Isopole 2-Meter Antenna," *QST*, April 1980.

[9] Belrose, J., "Notes on Coaxial Baluns," *QST*, June 1983.

[10] Jasik, H. (Editor), *Antenna Engineering Handbook*, McGraw-Hill, 1961, pp. 22-4 to 22-14.

[11] Reynolds, D.K., *Facts About Proper VHF Vertical Antenna Design*, (pamphlet), Advanced Electronic Applications, Seattle, WA, 1979.

[12] O'Dell, P., "Decouple VHF Verticals," *QST*, April 1982.

[13] A coaxial (unbalanced) feedline connected directly to a center-fed dipole (a point of voltage balance) also suffers from feedline radiation due to outside-of-shield current flow. This may or may not be desirable. Use of a voltage-type balun at the feed point eliminates this cause of it.

[14] *The ARRL Antenna Book*, 13th Edition, ARRL, 1978, Figures 4-7 and 4-8.

[15] Moxon, L.A., *HF Antennas for All Loca-*

*tions*, Radio Society of Great Britain, 1982, Figure 5.2.

[16] Palmer, B.R., "Ferrite Shield-Current Chokes Cure Stray RF on Vertical-Antenna Transmission Lines," "Hints and Kinks," *QST*, January 1994, p. 78.

[17] Lewallen, R., "MININEC: The Other Edge of the Sword," *QST*, February 1991.

[18] Fisk, J., "Receiver Sensitivity, Noise Figure and Dynamic Range," *Ham Radio*, October 1975.

[19] *The ARRL Antenna Book*, op. cit., pp. 135, 137.

[20] Decasari, R.J., "The FM Advantage," *Ham Radio*, September 1984. At low signal strengths (low carrier-to-noise ratio), FM's signal-to-noise ratio is markedly inferior (it takes about 9 dB more carrier strength for an equal signal-to-noise ratio) to SSB. At higher signal strengths, its signal-to-noise ratio is superior. The crossover region is called the FM threshold. At low signal strengths, small improvements in carrier-to-noise ratio give big increases in FM signal-to-noise ratio. This can exaggerate antenna gain and/or gain-to-noise ratio improvements.

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# The CW Operator's Friend

*Simply push a button and send those frequently-repeated CQs, IDs and QTHs.*

by Herbert M. Rosenthal WV5Q

I read "The Morse Messenger" by Scott Edwards KF7VS (73 *Amateur Radio Today*, June 1994, page 46) with keen interest. His device uses a PIC chip in a CW message generator for foxhunts, repeaters, etc. I thought I could use the chip in an add-on to my squeeze key and MFJ keyer. The idea was to place several "buttons" in close proximity to the paddles, and to put the electronics inside the keyer. Then, with just an inch or so movement from the paddles to the buttons, I could summon up a CQ or "OP HR IS HERB HERB" sequence with the touch of a button. This adjunct would certainly eliminate manual sending of many repeat messages.

Well, I put it all together, and it works just great! I'd like to share this with all the CW ops. Refer to the original article as you read this. Here goes:

## It's Simple!

I ordered a chip from Scott, programmed with my call and sequences for DE, CQ, CQ DX, QTH, and OP, following his instructions to count spaces and to limit the total count to 92 for all six messages. Figure 1 shows my messages; the combination of highs/lowers necessary on the M0, M1, and M2 memory select lines remains the same for any message. An array of 1N914 diodes and pull-up resistors is used to make each of the six buttons select the proper message; this takes 17 diodes and three resistors. They are mounted

on the same perfboard that holds the message buttons. This board fits mostly under the key, and the buttons stick out in front, very close to the paddles, three on each side of the paddles. Mount the board to the key as you wish; I used duct tape. The speaker (audio) output and tone-select functions are not used.

The rest of the electronics is mounted on a small piece of perfboard, with a socket for the PIC chip. Then the assembly is direct-wired to the keyer, wrapped with a turn or two of paper to prevent shorts, and stuffed inside the keyer cabinet. A thin, six-conductor shielded cable connects to the perfboard under the keyer, and you're up and running. Use tiny switches that take just the barest touch to operate—Digi-Key has such switches; Radio Shack 275-016 switches will work, but they are not really small. Look for small, sensitive switches. Defunct computer mice are a good source for switches and cable.

A diode connected to each switch grounds a common R-C-R circuit to give a negative-going pulse for the trigger line. Thus, any key depressed selects its message and also triggers the start of the message.

The XMTR LED is mounted on the keyer panel as a "RUN" indicator, and serves to advise you when a message sequence is complete.

## Modification

There is a 0.5-second delay programmed in the software that is *undesirable* for this ap-

plication; it takes too long at moderate CW speed for the message to begin. I reduced this wait time by speeding up the operating frequency of the chip, replacing the original RC components with a 10 pF capacitor and a 1,500 ohm fixed resistor in series with a 10k ohm pot. Of course, this throws the original speeds way off, but with the new pot set at zero ohms, and the three speed lines pulled to zero, the original 7 wpm is now about 18 wpm, and the start delay is about 0.1 second—acceptable. To QRS, increase the setting of the pot; this *does* increase the start delay, but it's manageable.

They KEY output drives an inverting NPN transistor to give a low-going CW sequence. I wired this to the manual key input of the MFJ keyer (pin 20 on the Curtis 8044ABM chip). Others may use this transistor to operate a reed relay as shown; the contacts are then "clean" and may be used for positive or negative keying, or connected across your keyer's output.

That's it. The temptation to do a repeat circuit for the CQ messages was strong, but I decided against this; a single 3x2 suffices.

I have written Scott, suggesting that he consider re-doing the PIC program for the button function. This would eliminate the memory diodes, the turn-on delay, the start trigger, the tone and speaker leads, providing a simple one-chip, six-button keyer. Until such a chip is available, you can do it "my way."

See Figure 1 on page 38

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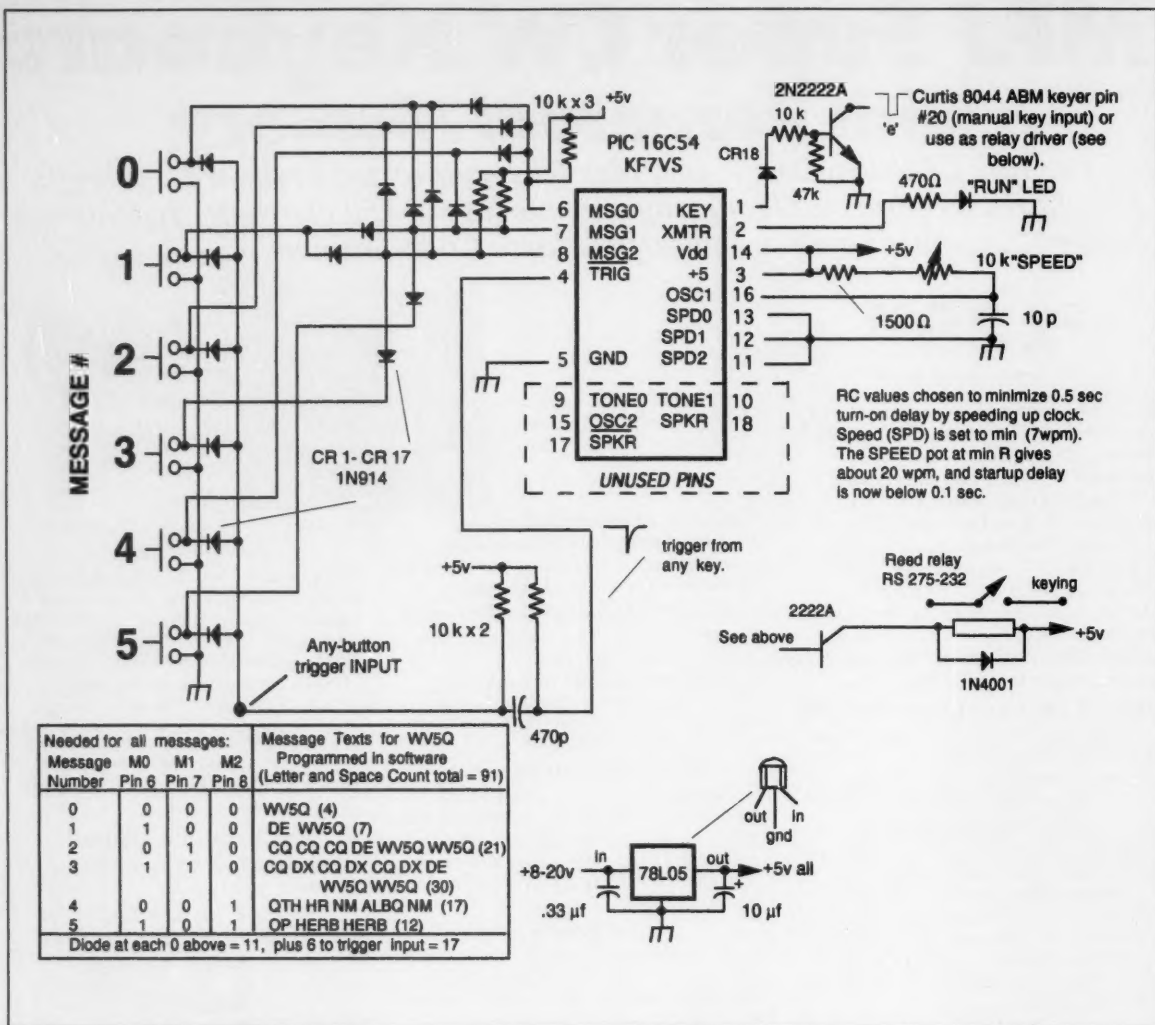


Figure 1. K7VS Morse Messenger as PIC Button Keyer. Adapted by Herbert M. Rosenthal WV5Q, 1994.

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by Frank Kamp K5DKZ

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In the case of the series-connected diode, reversing the power leads will prevent the circuit from drawing current. The resulting operational failure can be easily corrected by reversing the power supply leads. Unfortunately, there are a multitude of other factors that can lead to operational failure. Most probably, the user did not reverse-connect the power leads intentionally. That lack of intent could have a person needlessly searching for other causes of failure before discovering the reverse connection. Intentionally reverse-connecting the power

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positive input of the circuit. The negative output of the bridge is connected to the negative input of the circuit. Now, power of either polarity can be applied to the AC terminals of the bridge and the load will still receive properly polarized supply current.

This trick is not without some minor drawbacks. The most significant drawback is the additional voltage drop across the extra diodes. In the case of silicon diodes, you will experience a 1.4 volt drop between the input and output of the bridge. A power dissipation concern becomes a problem when load currents in excess of a few amps are required. A 2 amp load will dissipate almost 3 watts in the diodes.

The usefulness of this method far outweighs its drawbacks when we apply it to low-current devices that have their own voltage regulation. If we add a large-value filter capacitor across the output of the bridge, we end up with a device that can have a large range of power sources. Either AC or DC wall bug-style supplies could be employed and we would no longer have to worry about the polarity of the DC supplies. We can now use any source of AC or DC for input to the bridge, assuming its supply voltage is

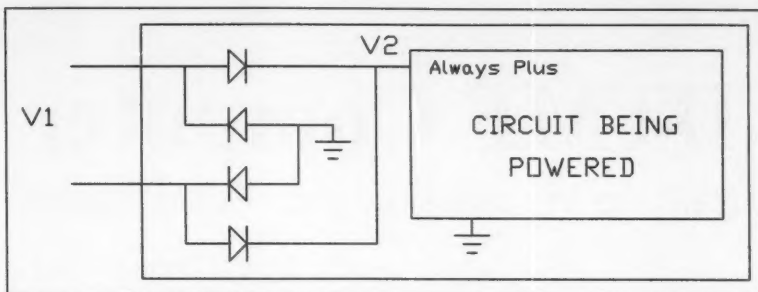


Figure 1. V1: Any polarity DC voltage 1 or 2 volts greater than that required at V2. The current rating must be sufficient for the circuit being powered.

large enough to overcome the 1.4-volt drop through the bridge and the possible 3-volt drop through any regulators in the load. This generally means that a wall bug-style

circuit uses devices that operate over a large voltage range, like CMOS devices, regulation might not be required at all. In such an application, power sources with voltages ranging from 5 to 16 volts AC or DC could be employed.

So now we have polarity protection, polarity correction, and the versatility of using a large range of assorted AC or DC power supplies. I figure that is a lot of performance for the cost of three additional diodes.

***"The usefulness of this method far outweighs its drawbacks when we apply it to low-current devices that have their own voltage regulation."***

supply with a minimum of 9 volts will be required for a 5-volt circuit. A 12-volt circuit will need a 16-volt supply. If the cir-

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Since the TigerTail is in effect a counterpoise (or the missing half of the dipole), I expected some improvement in signal strength, but the results were far better than I anticipated.

Without TigerTail when I transmitted on low power (1W), Gayle recorded an S-3 signal with 15 percent white noise. With TigerTail, the reading was S-7, and full

quieting.

On high power (2.5W) the meter displayed an S-5 with a small percentage of noise. On high power with the TigerTail, the reading jumped to S-9.

With TigerTail I did better on low power than on high power without it. That saves my battery pack. Besides, the improvement in receiving Gayle's signal was excellent. So there you have it. A completely subjective, non-scientific report.

If you backpack, are involved in search and rescue or help out on public service events, this little device could prove invaluable.

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# DTMF Computer Interface

*Harness the power of your PC to operate DTMF tone controls.*

by Richard Taylor K7CAH

The Capitol Peak Repeater Group operates five repeaters on Capitol Peak, near Olympia, Washington. Three of the repeaters are linking repeaters for the Evergreen Intertie system. One repeater is on 145.47 and one is a redundant repeater that can be switched in or out of the system. The entire configuration is controlled by two microprocessor-based controllers with programmable speech, voltage and temperature sensors, an autopatch, and weather receivers.

There are over 600 user and control codes involved in the setup and operation

of the two controllers. This does not include the speech or macro programming. A hard reset of the system involves the long and tedious job of reprogramming. Also, changing system configurations requires inputting several long strings of digits, one at a time. A faster means of programming the repeaters was clearly needed.

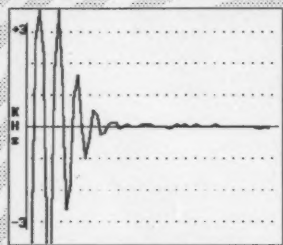
The following computer interface evolved out of this need. It is a small, easily-built unit that interfaces an IBM-compatible computer with the mike input of the transceiver. It generates all 16 DTMF tones that are inputted from the computer key-

board. With a little modification it can also be used through telephone lines.

The interface was designed around the SK22859 tone-generator chip. This chip is used primarily as a replacement for the tone generators in telephone Touch-Tone pads and is readily available. It is also capable of generating all 16 DTMF tones and uses an easily-available 3.58 MHz TV type crystal in its oscillator circuit. The chip is a low-voltage (3 volts) low-current device, which makes it ideal to use with a laptop computer both in the field and at home. The interface connects to the computer via

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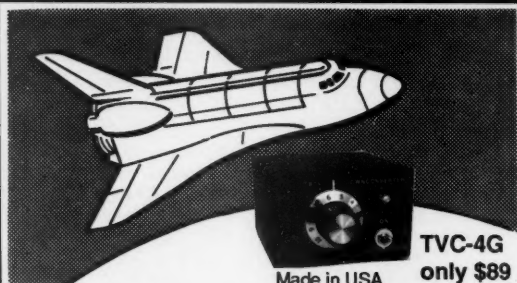
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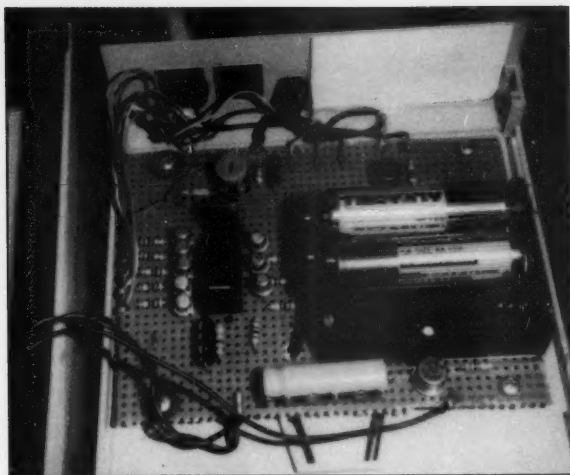


Photo A. An early prototype of the DTMF Computer Interface built on perfboard.

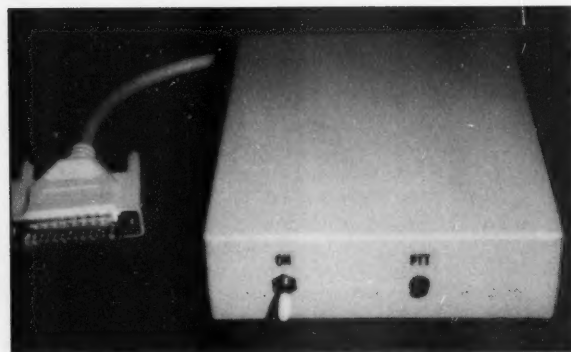


Photo B. The DTMF Computer Interface looks inconspicuous in its own little box.

the parallel printer port. This port can be programmed for both input or output, and is probably one of the easiest ports to use to connect outside devices to the computer.

#### Operation

The standard DTMF (Dual-Tone Multiple-Frequency) keypad is arranged in rows and columns (see Figure 1). Each row and each column has a single frequency tone associated with it. By connecting a row and a column together, two tones are generated and combined to produce a standard dual tone associated with a particular digit or letter (A, B, C, D). To produce the dual tone for the digit 3, row 1 is connected to column 3. This produces and combines the tones of 697 Hz and 1477 Hz, representing the digit 3. Tone generating and combining is done within the SK22859 IC. By grounding both a row and a column on the IC, the proper tone is produced. Output is audio, sufficient to drive a small speaker.

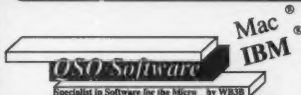
Instead of the DTMF keypad, the

computer printer port is used. This port is easily programmable in BASICS and is readily

accessible without any modification to the computer. The portion of this port that we are mainly interested in is the eight "Data" lines and the "Strobe" line. The Strobe line is used to key the mike PTT. Each of the

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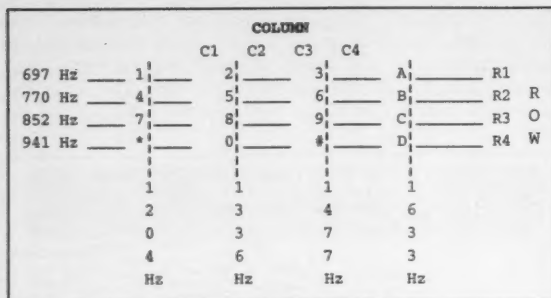


Figure 1. DTMF keypad.

data lines is either on or off (+5 volts or 0), depending on the binary number associated with all eight data lines (see Figure 2). Possible combinations of 255 numbers are available; however, only 16 numbers are used for our interface. The combination of four rows and four columns on a DTMF pad and eight data lines works out well. All we need to do is assign each data line to act like a row or column on a DTMF keypad. We then program the computer to output the correct binary number to the printer data lines that represent the decimal digit entered at the keyboard. The binary output from the printer port (+5 volts or 0) is sent to the IC keying transistors. The keying transistors ground either a row or column line on the IC. At the same time, the Strobe line is keyed on. This in turn keys (grounds) the transceiver PTT line and sends the appropriate tone out over the air.

As is usually the case, there is always something that makes a simple project just a little more difficult. However, in this case it is just a minor irritation. Not all computers use the same port assignment to access the printer port. LPT1 and LPT2 are used to designate the printer ports. LPT1 should have an address assignment of decimal 956 or 888 and LPT2 of 632. The strobe line address will be either 890, 958, or 634. So far, I haven't found any computers that do not use at least one of the above port address assignments. However, if you have

trouble running the program, consult your computer manual and make sure at least one of the printer port assignments matches one of the above. In the program listing, the printer port used is LPT1, with a port assignment of 888 and strobe assignment of 890 (C=888; W=890). If the program will not operate, change C and W.

#### Construction

Parts placement is not critical. I used Radio Shack perfboard for component mounting on the prototype shown in Photo A. You can also use a drilled and etched PC board, like the one pictured in Figure 5. All the switching transistors are 2N2222, although any general-purpose NPN transistor should work. Parts values also are not too critical. However, the 680 ohm load resistor (R5) on pin 16 of the IC should be as close as possible. The SK22859 IC is static sensitive, so it is best to use an IC socket and install the IC after all the wiring has been completed.

I cut a six-foot DB25 double-male computer cable in half to obtain the plug and cable to plug into the printer port. Use an ohmmeter to trace out the pins and wire colors for the data and strobe lines. A much neater installation would be to use a

Row/Column	R4	R3	R2	R1	C4	C3	C2	C1	Decimal value for BASIC "OUT" command
Data line #	8	7	6	5	4	3	2	1	
Decimal	128	64	32	16	8	4	2	1	
1	0	0	0	1	0	0	0	1	17
2	0	0	0	1	0	0	1	0	18
3	0	0	0	1	0	1	0	0	20
4	0	0	1	0	0	0	0	1	33
5	0	0	1	0	0	0	1	0	34
6	0	0	1	0	0	1	0	0	36
7	0	1	0	0	0	0	0	1	65
8	0	1	0	0	0	0	1	0	66
9	0	1	0	0	0	1	0	0	68
*	1	0	0	0	0	0	0	1	129
0	1	0	0	0	0	0	1	0	130
#	1	0	0	0	0	1	0	0	132
A	0	0	0	1	1	0	0	0	24
B	0	0	1	0	1	0	0	0	40
C	0	1	0	0	1	0	0	0	72

Figure 2. Printer port data output lines.

DB25 jack mounted to the project box, and use a separate cable to connect it to the computer.

Most transceivers today use a 600 ohm microphone impedance. The interface audio can be wired into the microphone input along with the station mike without causing any loading. If you have a high impedance mike input on your radio, you may have to disconnect the station mike while using the interface.

I used a 3 volt wall-type transformer power supply to power the unit. This is the type used to power small battery-operated cassette recorders and is available at Radio Shack. For portable operation, two AA batteries in series work just fine. However, do not put more than 5 volts across the IC. S1 is a double-pole single-throw switch. S1A applies power to the circuit, while S1B connects the strobe line. The interface should be turned off when not in use to prevent inadvertent transmitter key-up when the computer is used for other programs.

#### Operation

The program listed was written in GW-

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```

100 CLS
110 C=888:REM DATA LINE ASSIGNMENT. LPT1 888 OR 956 LPT2 632
120 W=890:REM STROBE LINE ASSIGNMENT. LPT1 890 OR 958 LPT2 634
130 PRINT:PRINT:PRINT
140 PRINT "INPUT ONE LINE AT A TIME. PRESS ENTER TO SEND"
150 PRINT "PRESS ENTER ON A EMPTY LINE TO QUIT"
160 PRINT:PRINT:
170 LINE INPUT I$
190 IF I$="" THEN END
200 OUT C,0: REM SET ALL DATA LINES TO 0
210 OUT W,12: REM KEY TRANSMITTER
220 FOR N=1 TO 100:NEXT N
230 FOR M=1 TO LEN(I$)
240 AS=MID$(I$,M,1):GOSUB 1020
250 AS=" "
260 NEXT M
270 OUT W,13: REM TURN OFF TRANSMITTER
280 GOTO 170
1020 REM OUTPUT ROUTINE
1030 IF AS="1" THEN OUT C,17:GOSUB 1190
1040 IF AS="2" THEN OUT C,18:GOSUB 1190
1050 IF AS="3" THEN OUT C,20:GOSUB 1190
1060 IF AS="4" THEN OUT C,33:GOSUB 1190
1070 IF AS="5" THEN OUT C,34:GOSUB 1190
1080 IF AS="6" THEN OUT C,36:GOSUB 1190
1090 IF AS="7" THEN OUT C,65:GOSUB 1190
1100 IF AS="8" THEN OUT C,66:GOSUB 1190
1110 IF AS="9" THEN OUT C,68:GOSUB 1190
1120 IF AS="0" THEN OUT C,130:GOSUB 1190
1130 IF AS="*" THEN OUT C,129:GOSUB 1190
1140 IF AS="#" THEN OUT C,132:GOSUB 1190
1150 IF AS="A" OR AS="a" THEN OUT C,24:GOSUB 1190
1160 IF AS="B" OR AS="b" THEN OUT C,40:GOSUB 1190
1170 IF AS="C" OR AS="c" THEN OUT C,72:GOSUB 1190
1180 IF AS="D" OR AS="d" THEN OUT C,136:GOSUB 1190
1190 FOR T=1 TO 900:NEXT T:REM HOW FAST TONES ARE SENT
1200 OUT C,0:REM SET ALL DATA LINES TO 0
1210 RETURN

```

[illegible]

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
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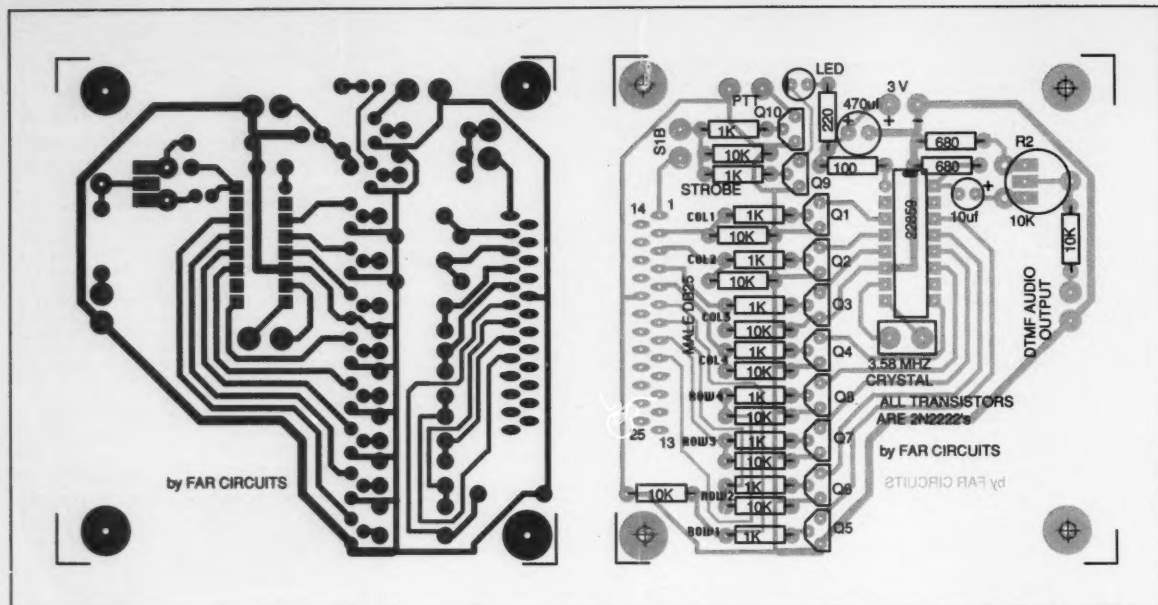


Figure 5. Drilled and etched PC boards are available for \$4.50 plus \$1.50 S & H per order from FAR Circuits, 18N640 Field Ct., Dundee, IL 60118.

BASIC and should run on any computer using DOS 2.0 or greater. Bring up BASIC on your computer, then type in and save the program. Connect the interface to your computer printer port and the radio to the interface. Run the program and input several numbers. When the ENTER key is pressed on the computer, the radio PTT should light and DTMF tones should be sent out over the air. If the PTT light does not light, change W in line 120 of the program. If no tones are outputted, change C in line 110. Once the program and interface are up and running, adjust R2 to obtain 3 to 3.5 kHz deviation. This will be the point

just above the threshold where the tones will access your repeater. Too much audio will cause distortion in your radio and will not be decoded at the repeater.

Connecting two rows to ground produces a single frequency tone. The BASIC command "Out C,48" (see text for the value of C) connects Row 1 and Row 2 to ground, producing a single tone. This can be useful for producing a test tone or, with a little programming, to send your call in CW.

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#### Parts List

- 1 Tone generator, RCA SK22859 or CD22859E
- 10 2N2222 transistors or equivalent
- 1 10k ohm variable resistor
- 1 100 ohm resistor
- 1 680 ohm resistor
- 10 1k ohm resistor
- 9 10k ohm resistor
- 1 470 µF capacitor
- 1 10 µF capacitor
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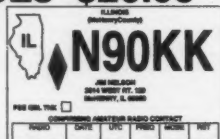
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by Gordon West WB6NOA

Benchner, Inc.  
831 N. Central Avenue  
Wood Dale IL 60191  
Telephone: (708) 238-1183;  
Fax (708) 238-1186

Price Class: RJ-1 (black-painted steel base)—\$69.95;  
RJ-2 (chrome-plated base)—\$79.95

# The Benchner Chrome Straight Key

*Experience the feel of a well-built code key.*

Remember the days of the J-38 key and its unique feel? If you enjoy the touch and mechanics of a straight key, plus the familiar click-action of sending without paddles, you will enjoy using the new Benchner RJ-1 that will bring back some wonderful straight key memories.

"Give me a good straight key, and I'll have a race with you on any electronic keyer," quipped the late Jim Rafferty N6RJ. The "RJ" designation on the Benchner straight key is a memorial to one of the finest CW operators in the country. "The action of a good straight key has got to be felt to be appreciated," said Rafferty.

The Benchner straight key was developed in response to requests from a number of customers and dealers wanting something new from CW key guru Bob Locher W9KNI. You can tune in Bob most evenings at the very bottom of the 20 meter band. Need I say more? I have witnessed him drinking a cup of coffee, munching a sandwich, and carrying on a conversation, all the time sending CW to a rare DX station somewhere else in the world!

"Although there are conventional straight key designs that we studied, no effort was made to copy them," comments Locher. "We wanted our engineering team to create a

product that would utilize modern materials and manufacturing techniques to meet the traditional straight key requirements," adds Locher. The RJ-1 chrome-plated key on a black-painted steel base uses oil-impregnated sintered bearings at all pivot points, and stainless steel adjustment screws. Of course, a complete range of locking adjustments of all movement and tensioning is provided along with an Allen wrench for the adjustment that feels right to you.

"We assemble everything at the same place where we turn out our popular Benchner paddles," adds Locher. "And we are talking about assembly personnel at our facilities who have the skills of a Swiss watchmaker—white gloves and the works," smiles Locher.

## The Expert Users Approve!

We ran our tests on the Model RJ-2. And, while you might not think that there is any good way to test a straight key, we found the best way was to invite accomplished CW enthusiasts to come over and rate its feel. "I'm going to retire my J-38," comments Bob Gregg AB6CH. "I liked the oversized black plastic knob with a second plastic ring to rest my fingers on," comments Roy Stephens AC6CQ. "The soldered tabs on the bottom also make for a quick hook-up," adds

Stephens. On the bottom of the key there is also a holder for the Allen wrench adjustment tool, plus a plastic strain relief to keep your two-conductor keyline from tugging at the soldered connections.

The base of the key is common with one side of the key line solder lug. The other side is insulated off of the base, and connects to the gold-plated contacts that gave us a crisp open-and-close connection. Locher indicates that these are the same contact points that are found in all of his proven Benchner paddles.

For adjustments, you've got them! We found that you could adjust the knob height, adjust the contact spacing, and adjust the spring tension all with knurled knobs. The Allen wrench is there only if you need to completely strip down the key for an annual cleaning.

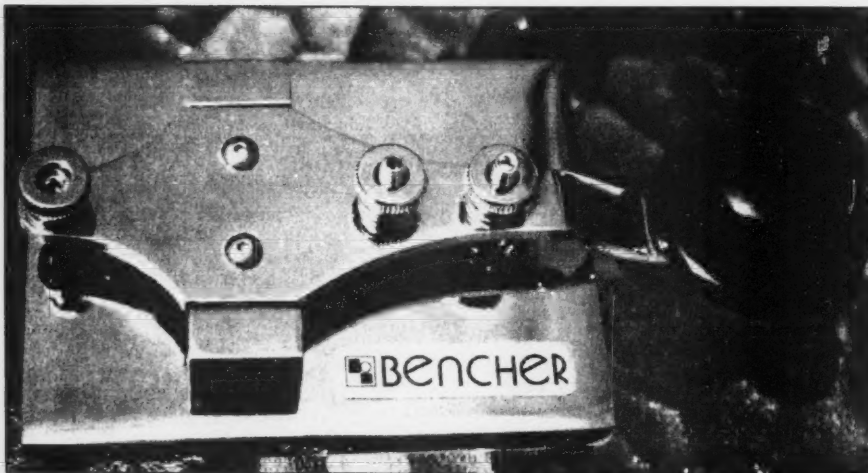
A set of instructions cautions never to spray any contact cleaner into the ball bearings. It also cautions against using steel wool or abrasive cleaners on any Benchner key or paddle. The bearings are Oilite, and no lubrication should ever be needed.

Best of all, the key is massively heavy, so it won't be hopping around your operating desk as you are pounding out those dits and dahs. And, just like all Benchner paddles, the key should last for a lifetime of amateur radio operation.

Departing from its traditional practice of using the prefixes of rare countries as the product identifier in the paddles, the "RJ" designation is to honor the memory of Jim Rafferty N6RJ, who was a close friend and once fellow co-worker of Benchner Management.

The keys are available in two versions—RJ-1 for \$69.95 with chrome-plated parts on a black-painted steel base, and RJ-2 for about \$79.95 with chrome-plated parts on a chrome-plated base.

For more information on the complete line of Benchner paddles, keys, baluns, and filters, write Benchner, Inc., 831 N. Central Avenue, Wood Dale, Illinois 60191; (708) 238-1183.



# MFJ Keyers

More hams use MFJ keyers than all others in the world! Choose the one that's right for you. Write or call toll-free 800-647-1800 for more info.

MFJ-422B

**\$134.95**

## MFJ Keyer/Benchner

**Paddle Combo** is the world's most popular keyer because it's the best of all CW worlds -- a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Benchner iambic paddle! Iambic keying, speed, weight, tone, volume controls. Automatic or semi-automatic bug modes. RF proof. MFJ-422BX, \$79.95, keyer only.

**Deluxe Keyer, MFJ-407C, \$69.95**, gives you easy access *front panel* speed, weight, volume, tone controls, all keyer modes, dot-dash memories, jam-proof spacing, sidetone, speaker.

**Econo Keyer, MFJ-401B, \$49.95**, for dual iambic or single lever paddles. Sidetone, speaker, volume, speed, internal weight and tone controls.

## Memory Keyers

**Menu Driven -- so easy-to-use you don't need an instruction manual!**

MFJ-490

**\$164.95**

## MenuDriven Memory

**Keyer™** in a compact package mounted on a Benchner iambic paddle. Store 192 characters in 4 message memories. Morse trainer, sidetone, automatic serial numbering plus all the features of MFJ-492 except remote control jack and extra memory. MFJ-490X, \$109.95, keyer only, no paddle.

MFJ-492

**\$99.95**

## MenuDriven

**Memory Keyer™** stores 192 characters in 4 battery backed-up message memories. Expands to 8000 characters, 8 memories with MFJ-80, \$14.95. Automatic, semi-automatic bug or handkey modes, reverse dot/dash paddles, select iambic A or B or non-iambic modes. Morse trainer, automatic serial numbering, sidetone, volume and speed panel controls, remote control jack, plus more.

**Super MenuDriven Memory Keyer™** MFJ-493, \$139.95, is the world's most sophisticated memory keyer. Stores 32,000 characters! Plug in AT keyboard and it turns into full featured CW keyboard. Serial port lets your computer control your keyer, compose, edit, display, save messages and record your transmissions. FCC Exam Simulator, QSO Simulator, Word Recognition Trainer, remote control jack, plus all the features of MFJ-492.

MFJ-492/493 Remote Control, MFJ-78, \$19.95.

## CW Keyboard

MFJ-451

**\$99.95**

Stand alone CW Keyboard includes AT type keyboard, 200 character type-ahead buffer, two 100 character nonvolatile message memories, more.

MFJ-451X, \$79.95, keyboard interface only.

## MFJ Iambic Paddles

MFJ-564

**\$49.95**

## MFJ Deluxe

Iambic Paddle features full range of adjustments in tension and contact spacing, self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. For all keyers.

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Take this tiny MFJ 20 Meter SSB Travel Radio™ with you and enjoy DXing and ragchewing wherever you go.

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(20 Meters)

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You'll be amazed at how easy it is to work the world. Countries you've worked in the past become fair game once again.

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**Plug-in options:** MFJ-412, \$39.95, Curtis keyer; MFJ-726, \$29.95, narrow audio filter.

## Portable Accessories

MFJ-971

**\$89.95**



**Antenna Tuner, MFJ-971, \$89.95.** Tunes coax, balanced lines, random wire, 1.8-30 MHz, Cross-Needle SWR/Wattmeter with two ranges.

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**AC Power Supply, MFJ-4110, \$39.95.** Travel light and leave the heavy hardware at home. 110 VAC power supply delivers 13.8 VDC, 2 amps from rugged wall adapter and regulator module.

**Antenna, \$34.95.** Lightweight easy-to-carry single band folded dipoles for MFJ rigs and others. Specify 40, 30, 20, 17, 15 Meters.

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MFJ-557

**\$24.95**



# Mobile Handbook

A super hands-on book with hundreds of useful ideas to make mobiling great!



MFJ-33 See how easy it

**\$12.95** is to have a

ham shack in

your car with this idea

filled Mobile Handbook!

For the beginning

mobiler, Dave Ingram

K4TWJ shows you how

to set up a super mobile

installation! For the experienced, K4TWJ includes hundreds of useful ideas for mobiling on HF, VHF, 10 meters and FM, QRP and legal limit mobiling, mobile antennas and mobile CW.

**K4TWJ** shows you how to DX on the road, make antennas, reduce ignition noise and RFI.

## More ham radio books

**The Packet Radio Operators Handbook** by Buck Rogers K4ABT. How to build and use packet stations, Nodes, Rose switches, 9600 baud stations, trunks, backbones, networks, BBSSs, interfaces. MFJ-3036, \$12.95.

**Packet Radio is Made Easy** by Buck Rogers K4ABT. Makes packet easy! How to set up, digiposting, mailbox, more. MFJ-32, \$9.95.

**Easy-Up Antennas** by W3FQJ. Gives you inexpensive, easy to build antennas for virtually every SWL or ham need. MFJ-38, \$16.95.

**Troubleshooting Antennas and Feedlines** by W1TF. How to troubleshoot and get your antenna system performing. MFJ-3301, \$12.95.

**73 Dipole and Long-Wire Antennas**, 8 chapters, 7 appendices. MFJ-3302, \$12.95.

**73 Vertical, Beams and Triangle Antennas**. All built and tested by W3FQJ. MFJ-3303, \$12.95.

**Technician Antenna Handbook** by Larry Luchi, W7KZE. Build proven Tech/Novice antennas using common materials. MFJ-3304, \$12.95.

**Oscar Satellite Revue** by K4TWJ. How to set up a satellite station. Quick Start guide, tracking data and equipment review included. MFJ-31, \$7.95.

**The Shortwave Listener's Guide for Apartment/Condo Dwellers** by W3FQJ. Key to indoor SWling and DXing. MFJ-36, \$9.95.

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**The Fox Hunt Adventure** by Dave Casler KE0OG. Enjoy mystery and adventure as you follow a young group using ham radio to crack open a ring of drug dealers. MFJ-3101, \$7.95.

**The Wonderful World of Ham Radio: An Introduction for Young People** by Richard Skolnik KB4LCS. MFJ-35, \$7.95.

**Ham Radio Communications Circuit Files** by W3FQJ. 61 bipolar transistor, FET and linear integrated circuits. MFJ-37, \$9.95.

**Solid State QRP Projects**. 52 QRP projects in 8 chapters. MFJ-3502, \$12.95.

**FET Principles, Experiments and Projects**. Practical FET circuit design. MFJ-3504, \$16.95.

\*Reprints of older classics by Ed Noll, W3FQJ

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# RTTY LOOP

Number 16 on your Feedback card

## Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR  
6 Jenny Lane  
Baltimore MD 21206

Over the past 18 years, the December "RTTY Loop" has often served as a Guide to the Perplexed, answering that eternal question, "What gift to get for your favorite ham radio operator?" With Chanukah coming relatively early this year, beginning during Thanksgiving weekend, followed by Christmas and Kwanza at the traditional late December times, I thought it might be nice to return to those thrilling column ideas of yesteryear. So, with a hearty Hi Ho Silver, here we go!

As always, we will first take a look around 73rd Street (you're holding the directory in your hand). How about a good book? The National Amateur Radio Association offers a copy of Dave Ingram's *How To Get Started In Packet Radio*, reviewed in this column many months ago, for \$9.95 plus shipping. Call them at (206) 869-8052 for more information.

Chuck Harrington Software offers

PacketPet for Windows, an excellent packet terminal program described here a few months back. For \$49.95 plus shipping, this is a nice package. Call them at (407) 679-9017 for information, or take advantage of the shareware version, recently updated, on Disk #5 of the "RTTY Loop" disk collection.

**"Thank goodness for packet radio! If you are running Windows, OS/2, DESQview, etc., you will find paKet runs quite happily in the background as a simple DOS task."**

Packet Power is a new periodical which looks interesting. I have not seen an issue, but their ad in 73 gives an address of Box 189, Burleson TX 76097. Might be worth a peek.

A little packet modem in a connector, suitable for use with the BayCom program on Disk #2 of the "RTTY Loop" disk collection, is available from Tigertronics for \$49.95 plus shipping. Call (800) 8BAYPAC for information.

Now, if all of these are just too rich for your blood, I have one more item up my sleeve that has just got to be affordable: Disk #7 of the "RTTY Loop" disk collection! This new disk comes complete with the following programs:

### paKet version 6 PAKET6.ZIP

Tony Lonsdale VK2DHU, the author of paKet, describes it as a communications program developed especially for use with packet radio, although it can be used for other modes with the appropriate equipment. It is designed to run on any IBM-compatible comput-

sophisticated if that is what you want.

The modern trend is towards Graphical Environments with the likes of Windows, or OS/2. paKet is written to run as a plain DOS program, so if you have an old XT with a CGA or even a Mono display system gathering dust in the corner, paKet will run on that just fine. Packet radio is an excellent application for the older systems that are not much use for anything else nowadays, so it is quite feasible to dedicate an older system to running paKet 24 hours per day. What else do we do with those older systems now? We used to give them to the wife or children to use as a word processor, play games, etc., but many modern word processors need at least 4MB RAM, 10 to 20 MB of disk, 80386, etc. . . . the good games are not much better. Thank goodness for packet radio! If you are running Windows, OS/2, DESQview, etc., you will find paKet runs quite happily in the background as a simple DOS task. In addition to providing the usual Terminal Mode where you can send and receive data via the TNC, the program provides many features and facilities to enhance the operation of your packet radio system. Such features include:

- Full Personal Message System with automatic Mail Forwarding to the BBS

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**NEW!**

Model HF9V-X (shown to the left) for 80/75, 40, 30, 20, 17, 15, 12, 10 and 6 meters.

**NEW!**

Model CPX counterpoise kit for Butternut models HF9V-X, HF6V, and HF6V-X; substitutes for ground or elevated radials. Self-supporting tubing bolts onto base of antenna. Mast not provided.



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1691 MHz Loop Yagi Antenna model 1691-LY(N)	\$99
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• Full online TNC help for your TNC commands

• Online Manual—this entire Manual is available in a pop-up window

• Interrupt driven communications, so you don't lose anything even when paKet is running in a multi tasking environment.

• Runs on COM1, COM2, COM3 or COM4

• Both Hardware and Software Handshaking supported

• Multiple windows for up to 10 simultaneous connections

• REMOTE Mode—(unattended access)

• Access to DOS, your favorite editor, and file LISTER from within paKet

• Automatic Script processing . . . etc., etc., etc.

paKet is fully configurable so you can customize a system especially to suit yourself. Setting up your system is but a matter of a few keystrokes. It will run with any TAPR-compatible TNC, and that includes just about all

TNCs on the market today.

#### Super Morse version 4.15 SM415.EXE

This is the latest version around of the premier Morse trainer program. The author, M. Lee Murrah, has created a program that teaches Morse as a

***"So there you have it. A variety of gifts, ranging from two bucks up, with something in there sure to satisfy the pickiest among us."***

foreign language, not just as disconnected sounds or letters. Supporting SoundBlaster compatible audio cards, capable of running under Windows, this is one very nice way to learn Morse.

#### EzPacket version 17a EZPKT17A.ZIP

Frank Domina N9MXI used the code written by Andrew C. Payne for the Poor Man's Packet (PMP) modem as a model for this program. With more than 95% of EzPacket being written from scratch, he hopes to replace the few bits left for low-level bit I/O in the next version.

The author feels this program is friendlier than the original PMP software, while offering more features. I

leave it to you all to decide.

#### Frequently Asked Questions FAQ-PAK.TXT

Picked up on the Internet, this is a text file which answers just about every question I've ever been asked about packet, including a few that I

have asked myself. For many of you, this might even beat \$10 bucks for a book!

#### A2Term version 3.01 A2TERM.BXY

With some anticipation, I am including this program, A2Term, an Apple IIe, //e, IIC terminal software for packet radio, PacTOR, AmTOR, etc. Featuring multiple screens using HOST mode with Kantronics TNC's. Contest features. Macros. File transmit/receive. Relay received data on one stream to another. "Braggs." Operate PacTOR/other HF modes while operating VHF packet at same time with KAM. Usable with all TNCs. Does NOT operate on Apple II, II+ or IIGS nor on Apple clones. Shrinkit! (3.4

archive. Please note that this is an APPLE program on an IBM PC disk! If you want this program on your Apple, you will need a friend with a PC to transfer it to you.

So there you have it. A variety of gifts, ranging from two bucks up, with something in there sure to satisfy the pickiest among us. Now, all you have to do is leave this issue of 73 lying open on the kitchen table, with a strategically placed circle or sticky note, and let the family take it from there! To receive any or all of the now seven disks in the "RTTY Loop" disk collection, send a self-addressed stamped envelope or E-mail message to me for the list of programs on each disk. Each disk collection is over 1.2 Mb of material, and will fit comfortably on a 1.4 Mb 3.5" PC compatible disk. Just send sufficient disks for the collections you want, \$2 in US funds for each disk to be filled, and a self-addressed, stamped disk mailer to return the disks to you, to the address at the top of the column.

As I look for your comments and questions, to the above SnailMail address, or via CompuServe 75036,2501; Delphi MarcWA3AJR; America Online MarcWA3AJR; or Internet MarcWA3AJR@aol.com—my family and I extend to you and yours the best for this holiday season, with health and happiness for all. See ya next year! 73

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CIRCLE 45 ON READER SERVICE CARD

# PACKET & COMPUTERS

Number 17 on your Feedback card

Jeffrey Sloman N1EWO  
c/o 73 Magazine  
70 Route 202 North  
Peterborough NH 03458

## Potluck

September was an incredibly busy month here. That's why you didn't see anything from me last month. (There is a two-month lag between writing and publishing.) I am barely recovered from the frenzy, so this month I am going to cover a variety of smaller items that got overlooked.

## Contacting Me

I apologize at the outset to my regular readers who have seen some of this information before. On the other hand, don't skip this section because you'll find a new E-mail address in here. There are three ways to reach me (and I am always glad to hear from you!):

## Electronic Mail

This is the best way to get in touch with me. The address is:

n1ewo@quest.net

and it can be used for any sort of communication. Comments and questions concerning the column, greetings, etc., are all OK here. Though you may find me listed on other services (CompuServe, AOL, BIX, MCI, etc.), I will NOT answer mail to those addresses. The IQuest address is reachable from anywhere on the Internet, and from any of the other services on which you will find me as a user. So, if you want an answer, use n1ewo@quest.net.

## Paper Mail

For those of you without E-mail access (you have got to change that!), paper mail care of the magazine (address at the top of this column) will do. Once again, any sort of question or comment is fine by this route. I answer paper mail as I have the time. I try to answer it all, but you guys like to write and sometimes I cannot handle the volume.

## Packet Mail

I am very pleased to be the first packet mail contact for many of my readers. Messages saying hello are always welcome, and I enjoy responding to let you know that I got your traffic. However, I simply cannot respond to packet mail that asks questions about the magazine or column—I cannot do business over ham radio. Please do not send me such mail—it is very frus-

## NA vs. NOAM

I got quite a response to my suggestion that you avoid the .NA ending to hierarchical addresses. To refresh your memory, I pointed out that .NA is the Internet specification for Namibia! The people in Namibia are not too pleased to handle traffic mistakenly routed there. The correct ending for North America is .NOAM, but it seems that many sysops do not have their BBSs configured to handle .NOAM. The result is that if you (correctly) address your North American-bound mail with .NOAM, it will sit on the BBS until the sysop changes it to .NA. The best strategy is probably just to leave that part of the address off completely, and let the sysop deal with it—the mail will probably make it.

## The Internet

It is about time that each of you finds a way to access the Internet. I am not just talking about E-mail, I am talking about a full-fledged SLIP (Serial Line Internet Protocol) connection that puts your machine on the Net. Here's how it works: With a SLIP connection you use special software to

any host out there is. So what can you do? Anything that can be done on the Net. This includes the obvious, like E-mail, and many utilities that we have discussed here in the coverage of JNOS, like finger, ftp, etc. It also includes exciting things like WWW (World Wide Web). WWW is a graphical, hypertext-based way to find and use information out on the Net. The most popular implementations run under Windows, and you can spend hours looking around with a WWW client.

How do you get connected? That depends upon where you are. There are many Internet Providers across the country, some local, some regional, some national. A local or regional provider has the potential to be a better deal, and you'll probably find people you know using the service. A couple of examples of outstanding providers: If you are in Indiana, a company called IQuest Internet offers very low cost (about \$15/120 hours/month) SLIP. I am currently using IQuest for my own Internet connectivity and am quite pleased. In Massachusetts there is a company called Software Tool & Die. These folks have been around for quite a while and recently upgraded their host. I know quite a few satisfied users of STD's "World" host and their fees are reasonable. In New York, check out Panix, which is similar to these other two. There are many Internet providers out there; you'll need to talk to users about the service they have received to determine if the provider you are interested in is a good deal. If you are currently using a local/regional provider that you like, drop me a line to n1ewo@quest.net and let me know—I'll mention it here.

That's it for this month—next month I'll be ramped back up into a full-length column. Until then, I look forward to hearing from you. 73 de N1EWO.

**"A local or regional provider has the potential to be a better deal, and you'll probably find people you know using the service."**

trating; I cannot answer it. If you'd like to send a greeting, though, use: N1EWO@N0ARY.#NOCAL.CA.USA. NOAM

(Note: I am NOT in California; the N0ARY gateway forwards mail from the AX.25 network to and from the Internet. If you are interested in this service, send mail to BBS@ARA-SMITH.COM with any contact and you'll receive instructions.)

treat your modem as if it were a NIC (Network Interface Card). With this software in place, you call up a router—this could be a dedicated box which does nothing else or a port on a host that also supports logins—this depends on your Internet provider's configuration.

Once this connection is made, your machine—the PC on your desk—is actually on the Internet, the same way

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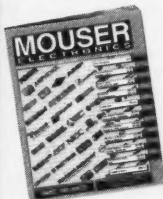
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## Single-Band Wideband Receiver Preamplifiers

If your HF receiver is a bit marginal on one or more bands, or if you build home-brew "minimalist" receivers (such as direct conversion receivers), then it is possible that the sensitivity is not up to snuff. The sensitivity problem for manufactured receivers is usually seen on older, low-cost models. Direct conversion receivers (DCR) sometimes suffer from sensitivity problems, especially those models that have considerable mixer loss (not usually a problem on NE-602 designs used by many hams, but often a problem with diode double-balanced mixers).

One possible solution to these problems is the use of a wideband preamplifier. However, if the "wide" part of wideband is too great, then it is possible that you will create as many problems as you solve. The wideband

preamplifiers will see all signals within its passband, and this may affect dynamic range or otherwise overload the front end of the receiver. This can especially be a problem with diode mixer DCRs, even those that use a single LC resonant circuit between the an-

tenna and the mixer input. If the problem is only on a single band, then it's possible to overcome the induced overload problem by limiting the bandwidth of the preamplifier.

**"The wideband preamplifiers will see all signals within its passband, and this may affect dynamic range or otherwise overload the front end of the receiver."**

tenna and the mixer input. If the problem is only on a single band, then it's possible to overcome the induced overload problem by limiting the bandwidth of the preamplifier.

This month we'll take a look at a single-band wideband amplifier based on the MAR-x series of RF integrated circuits. I first used this project in an article in a magazine dedicated to

scanners/SWLs for antennas for Jupiter reception. That application requires an 18-to-24 MHz bandwidth. One reader wrote to me and told me of using the preamplifier for his home-brew 15 meter ham band receiver used in "mountain topping" and other QRP applications. That idea struck a resonant chord!

Figure 1 shows the circuit for the single-band preamplifier. It consists of a wideband MAR-x amplifier IC preceded by a high-pass filter and a low-pass filter in series. The MAR-x de-

around 5 dB. The MAR-6 is a low-noise variant that operates to 2,000 MHz with gains to 20 dB in the lower frequencies with a noise figure of 2.8 dB. Both devices use the pinouts shown in Figure 1.

On all of the MAR-x devices the input is pin no. 1, and is identified by a color dot (brown on MAR-1 and white on MAR-6) and a bevel on the lead itself. The output is pin no. 3, while both pins 2 and 4 are grounds.

The DC power supply is connected to the output pin through a resistor and an optional RF choke (RFC1). The MAR-1 wants to see +5 VDC @ 17 mA and the MAR-6 wants to see +3.5 VDC @ 16 mA. The DC voltage regulator in Fig. 1 (i.e. U2) should be a 78L06 for MAR-1 circuits, and 78L05 for MAR-6 circuits. Both of these are available either under the part numbers (78L05 and 78L06), or as replacement part numbers from service replacement lines such as NTE and ECG. Ocean State Electronics carries the NTE Semiconductors replacement line [Note: 78L05 = NTE-977 and 78L06 = NTE-988].

The value of resistor R1 depends on the regulator and MAR-x device used. For either case:

$$R1 \text{ (ohms)} = V_o - V_{I_{mA}} \times 1,000$$

Where:

R1 is the value of resistor R1 in ohms;

$V_o$  is the output voltage of U2

V is the preferred terminal voltage of U1.

Equation [1] evaluates to 58 ohms for the MAR-1 conditions (use 56 ohms), and 88 ohms for MAR-6 conditions (use 91 ohms).

A printed circuit pattern for the circuit of Figure 1 is shown in Figure 2. If you don't want to bother making your own board, then you may order one from FAR Circuits (18N640 Field Court, Dundee IL 60118) for \$4.75 plus \$1.50 S & H per order.

The input circuit for the MAR-x device is a low-pass filter in series with a high-pass filter. The values for the inductors and capacitors are found from tables in *The ARRL Handbook for Radio Amateurs*. A limited set of these values (for 1 dB ripple factor) is:

L1 = K1/F <sub>MHz</sub>	=	17/F <sub>MHz</sub> $\mu$ H
L2 = K2/F <sub>MHz</sub>	=	24/F <sub>MHz</sub> $\mu$ H
L3 = K1/F <sub>MHz</sub>	=	17/F <sub>MHz</sub> $\mu$ H
L4 = K3/F <sub>MHz</sub>	=	7.3/F <sub>MHz</sub> $\mu$ H
C1 = K4/F <sub>MHz</sub>	=	3473/F <sub>MHz</sub> pF
C2 = K4/F <sub>MHz</sub>	=	3473/F <sub>MHz</sub> pF
C3 = K5/F <sub>MHz</sub>	=	2776/F <sub>MHz</sub> pF
C4 = K6/F <sub>MHz</sub>	=	1662/F <sub>MHz</sub> pF
C5 = K5/F <sub>MHz</sub>	=	2776/F <sub>MHz</sub> pF

If you want to build for 0.1 dB or 0.01 dB ripple, then see the *ARRL Handbook* for the K values. The inductors are made on toroid cores. Use either the T-50-2 or T-50-6, and wind the cores with enameled wire. The number of turns is found from:

$$N = 100 \sqrt{L_{\mu H} / A}$$

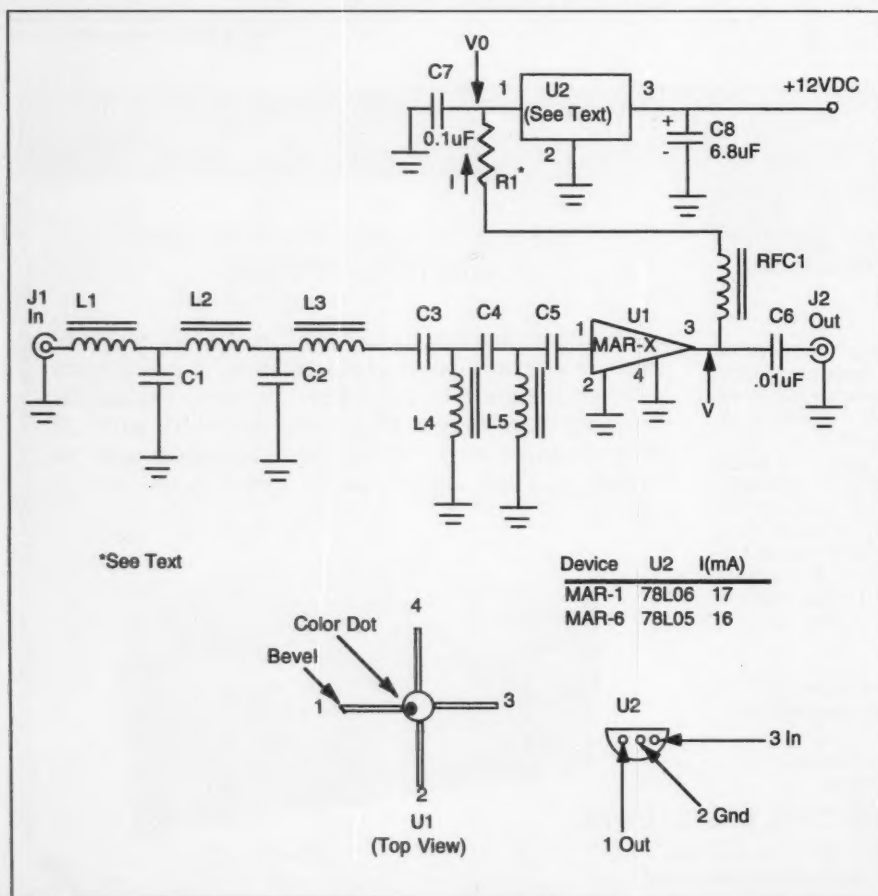


Figure 1. Circuit for single-band preamplifiers.

Where:

N is the number of turns;

$L_{\mu H}$  is the required inductance in microhenrys;

$A_L$  is a property of the toroidal core (49 for T-50-2 and 40 for T-50-6).

The last coil in the circuit (RFC1) is actually used as a peaking coil to improve the bandwidth. This coil should have an inductive reactance about four times the output impedance at the lowest frequency of operation. Because both input and output impedances on the MAR-x devices is 50 ohms, the inductive reactance of RFC1 should be on the order of 200 ohms (but the precise value is not terribly critical). Find the inductance from:

$$L_{\mu H} = 200 \text{ ohms} / 2\pi F_{\text{MHz}}$$

## ONE-BAND RECEIVER PREAMPLIFIER

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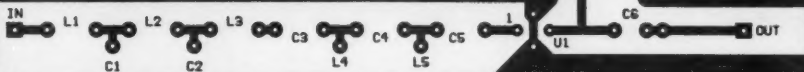


Figure 2. Printed circuit pattern for the circuit shown in Figure 1.

For example, for a 14 MHz receiver this equation evaluates to 2.3 fH. If a T-50-2 toroid core is used to make this coil, then 22 turns of wire are

required.

### Conclusion

The single-band receiver preampli-

fier will go a long way towards boosting the poor performance of marginal receivers. It is easy to build, and behaves quite nicely.

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## Low Power Operation

**Michael Bryce WB8VGE**  
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With the coming of winter, the days are shorter and the nights are longer, just perfect for some late-night QRPing. But, sometimes you're just not in the mood. Well, instead of talking your wife into letting you go to the next hamfest, how about firing up the word processor for some letter writing? I've compiled a list of current QRP clubs. This is the most complete list I've been able to compile.

**QRP ARCI**, c/o Mike Bryce WB8VGE, 2225 Mayflower NW, Massillon OH 44647. \$12 for new membership, \$10 for renewal, \$2 for info package.

**CW Operators QRP Club**, c/o Kevin Zietz VK5AKZ, 41 Tobruke Ave, St. Marys SA 5042 Australia. \$14 for US membership.

**G-QRP Club**, c/o Mike Kilgore KG5F, 2046 Ash Hill Road, Carrollton TX 75007. \$12 for US membership.

**Michigan QRP Club**, 654 Georgia, Marysville MI 49040. \$7 for new US membership.

**The Northwest QRP Club**, Bill Todd N7MFB, 2418 55th Ave S.W., Seattle WA 98116. \$10 for new members.

**The QRP Club of New England**, Jack Frake NG1G, P.O. Box 1153, Barnard VT 05031. \$10 for new US members.

**U-QRP Club**, P.O. Box 100, Saransk-31 Russia 430031. Unknown membership; newsletter is in Russian.

**NorCal QRP Club**, Jim Gates WA6GER, 3241 Eastwood Road, Sacramento CA 95821. \$5 for US membership.

**K5FO QRP Newsletter**, Chuck Adams, Twilight Publishing Co., 1301 Highway 407, Suite #353, Lewisville TX 75067. \$10 for 12 issues.

**St. Louis QRP Club**, Keith Arns KC0PP, 2832 PenBrooke Lane, St. Charles, MO 63301. Dues are unknown at this time.

**Oklahoma QRP Club**, OK QRP Group, Don Kelly, Editor, 703 West 8th Street Edmond OK 73003. No dues, but \$10 donation helps the club out.

**EA QRP CLUB**, c/o Sr. Miguel Molina, Avenida Rio De Janeiro 123 2-1 08016 Barcelona, Spain. No kidding, the newsletter is in Spanish.

**OK QRP CLUB**, c/o OK1CZ, Petr Doudera, U 1.Baterie 1, 16200 Praha 6, Czech Republic. 15 IRCs or \$10 dues. The newsletter has English translations for the most of the text.

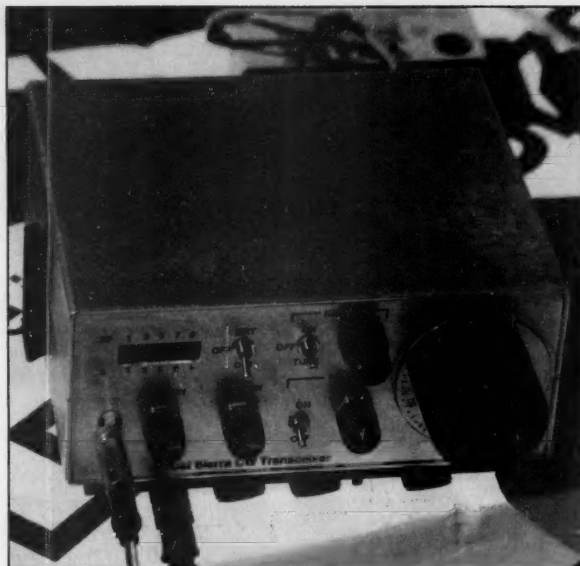


Photo A. The NorCal Sierra multiband transceiver.

**WI QRP Club**, P.O. Box 111, Brandon WI 53919-0111. Dues suggested: \$5-\$10.

**Central Pennsylvania QRP Society**, Cameron Bailey KT3A, P. O. Box 173, Mount Wolfe PA 17347.

**Colorado QRP Club**, Rich High W0HEP, 14261 East 4th Avenue #161, Aurora CO 80011-8711.

There, that should keep you busy!

### Home-Brew

If you've been thinking of a late-winter project, I've got two you may be interested in. Both are transceivers you can build for either 30 or 40 meters. The first one is the 40-40 rig made possible by the New England QRP Club. Late word has it the 40-40 is also available on 80 meters, and a 160 meter version is on the drawing board. The rig is on a single-sided PC board. This one board contains both the superhet receiver with a crystal filter and the 2 watt transmitter. Full electronic QSK is used for T/R control. The entire rig can be put inside your shirt pocket. The 40-40 was designed by Dave Benson NN1G. Kits are available from Dave for \$43, at 80 East Robbins Ave., Newington CT 06111.

What's unusual about this rig is the lack of an IF amplifier. From the mixer, the signal is routed through the crystal filter, and then directly to the BFO. There's plenty of gain in the chain for weak signal work, and without the hassle of tuning the IF for the correct peak. Only two crystals are used in the IF filter, but they are plenty narrow for CW work. Adding an extra crystal in such a simple rig does not increase the selectivity of the rig so much that most of us can hear.

Another important feature of the 40-40 is the way the tuning is accomplished. Instead of the usual variable capacitor, a varactor is used. A stable reference voltage is applied to the varactor via the front-mounted 100k tuning pot. This scheme works quite well. My first attempt, however, did not fly—out of the junk box came a 100k pot all right, but it had an audio taper instead of the required log taper. With this pot, the rig proved almost unusable. Use the proper taper on the tuning pot.

The 40-40 lacks two other fea-

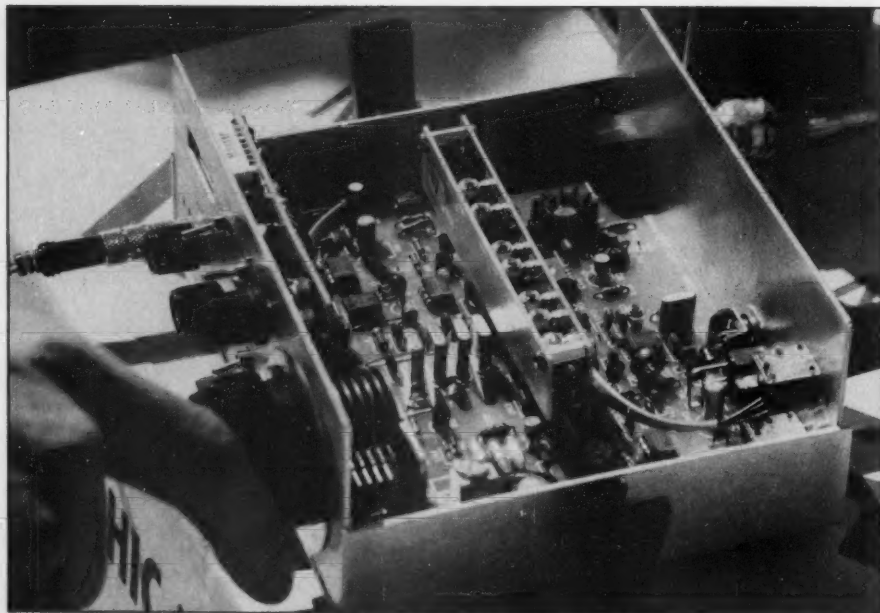


Photo B. Inside the NorCal Sierra. The plug-in band module is in the center.

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tures—a RIT and an AGC. You ride the volume control to keep strong signals from overloading the receiver. Adding a RIT control is possible, and I'll have some more details soon.

Another rig you'll be hearing a lot about is the Sierra from the NorCal group. The Sierra is the brain work of Wayne Burdick N6KR. This is an all band rig using plug in band modules. Operation from 160 meters through 10 will be possible, with the proper band module. This rig is a bit more complex than what we've seen coming from the NorCal group. It's a double-sided board with plated through holes. I've been told there's even gold plating on the band module fingers. It looks like a first class rig. I've not been able to get my hands on one, as they are still in the *get the bugs out* stage of development. I've included some photos of the rig, inside and out, so you can see what you'll be up against.

Bill Paul KD6JUI took a Sierra out for some bicycle mobile/hiking. Bill writes:

"Ten touring bicyclists, most of whom had never met one another, met at Crescent Lake, Oregon, on August 27 to ride a portion of the Pacific Crest Bicycle Trail for a week. Among them were two women, two Germans and four hams."



Photo C. The Pacific Crest Bike Tour. Clockwise, beginning at upper left: Russell Dwarshuis KB8U, Gottfried Kloyer DLZMFJ/AA1JQ, Cory Mitchum, Liz Burke, Jan Maurer, Rich Lesnik, Tom Hook, Dan Arbogast NØDA, Bill Paul KD6JUI, and Dan Ogilvie.

"The hams, Dan Arbogast NØDA of Corvallis, Oregon; Russell Dwarshuis KB8U of Ann Arbor, Michigan; Gottfried Kloyer DL2JUI of Wessling, Germany; and trip organizer Bill Paul KD6JUI of Dan Mateo, California; operated QRP HF from campgrounds along the way, as well as keeping 2 meter communications between slow and fast groups, and between groups taking slightly different routes.

"Dan Arbogast worked mostly 2 meter packet, while the other hams worked mostly 40 meter CW QRP, with some success: Japan, Alaska, Hawaii, Canada, and all the Pacific Coast states were worked.

"Antennas used were a 40 meter inverted V, a 20 meter end-fed dipole, a 40 meter half-wave vertical and a 40 meter ham stick mounted on a recumbent bicycle. Power in most cases was provided by solar cells. Paul successfully field-tests a prototype Sierra QRP rig being readied for its members by the Northern California QRP Club.

"Combining beautiful scenery with hamming, camping, rigorous bicycling (the cyclists climbed a cumulative 14,000' over a week) was a potent thrill for all radio amateurs involved."

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**SCALE** selects an amplitude sensitivity of either 10 dB/DIV or 2 dB/DIV.

**CENTER FREQUENCY** 4 digit LCD display.

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**REFERENCE LEVEL** adjusts input attenuator and IF gain. Calibrations in dBm and dBmV are provided.

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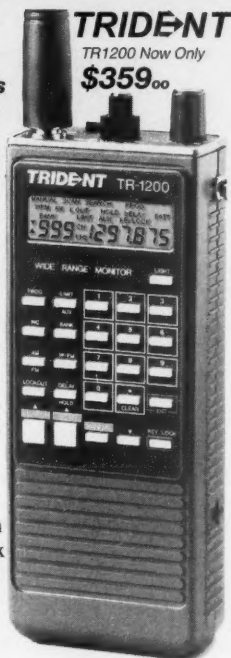
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## Where in the World are Geography Resources for Teachers?

"Okay, kids, now open up your geography books and let's read about the topography and climate of Ecuador." Students who are lucky enough to be in a classroom with a ham radio will never have to be subjected to this kind of introduction to a geography lesson.

Gone are the days when geography in a classroom referred only to the ability of students to spot places on a globe, or to mentally match cities with countries, or capitals with states. Sadly, many people have the perception that geography is about the location of specific places. As citizens of an "ever-shrinking" world, we can no longer afford to present a one-dimensional view of geography to our children.

Geography should be taught as a way of interpreting the world around us. Geography is an on-going phenomenon involved with history, culture, and a country's contemporary problems. Amateur radio in the classroom allows the teacher to teach geography on a need-to-know basis. My

classroom is set up in a way that allows easy access to wall maps, globes, and atlases. The students are always eager to point to the spot on the map where the voice on the radio is coming from.

There are many resources for the teacher of geography. Be sure to avail yourself of only the most current materials. Geography belongs as an integral part of the amateur radio curriculum for youngsters. An attractive QSL card from some faraway place, or a souvenir or snapshot from another state, can trigger off an entire social studies unit. The teacher who uses the radio must be flexible and ready at all times to respond to the interests and needs of the students.

Very often, I work with the social studies teachers at my school to better coordinate a really stimulating introductory session or to follow up a geography lesson in a meaningful way. The sixth-, seventh- and eighth-grade social studies students look forward to visiting the ham radio room. They know that they may not always make the contact we're looking for, but they also know that we'll probably meet someone new and different and that they will definitely have a fun time.

A group of social studies teachers and I put together this list of geography resources. Be sure to let me



Photo A. Students should enjoy learning about the world around them.

know about successes you've had with the creative use of amateur radio in the teaching of geography skills.

## The Geography Education National Implementation Project

The following booklets on *Guidelines for Geographic Education: Elementary and Secondary Schools* are published by the Geography Education National Implementation Project in cooperation with Rand McNally & Co. To order, contact the National Council on Geographic Education, Indiana University of Pennsylvania, Indiana PA 15705, or call (412) 357-6290; *K-6 Geography: Themes, Key Ideas, and Learning Opportunities*, 1987, \$6. This booklet addresses levels of thinking and dimensions of content for elementary students.

*7-12 Geography: Themes, Key Ideas, and Learning Opportunities*, 1989, \$6. The secondary level volume provides a framework for developing courses of study.

Grades 4-6 students participating in National Geographic Kids Network use computers and telecommunications to learn geography with their peers worldwide. For information, contact the NGS's Educational Services Division, PO Box 98018, Washington, DC 20090 or call 1-800-368-2728.

The 1994 Geography Assessment Framework (1992), developed to guide the NAEP Geography Assessment in 1994, is an extremely valuable instructional resource for teachers. Strongly influenced by public concern about our nation's geographic ignorance, it is constructed with one guiding question foremost in mind: "What fundamental geographic knowledge, understanding, and appli-

cations should students have mastered in order to be informed and productive 21st century citizens?" It clearly explains the dynamics of geography education and provides sample questions and objectives to illustrate the cumulative nature of geographic learning. Copies are available from the National Assessment Governing Board, 800 N. Capitol St., N.W., 8th floor, Washington DC 20001.

## General Reading

*Don't Know Much About Geography* by Kenneth Davis tells us fascinating facts about the world in an amusing yet extremely informative way. Published by Avon Books, NY; \$11.

*The Real World: Understanding the Modern World through the New Geography*, 1991; \$35; Houghton Mifflin Co. Students will love the beautiful photos. It addresses basic questions about the physical and social aspects of the contemporary world.

For parents: *Helping Your Child Learn Geography*, 1990, 50 cents. Order from: Consumer Information Center, Dept. 414Y, Pueblo CO 81009. By Carol Sue Frombolini, this booklet provides games and activities for ages 10 and under.

Resource Places: National Geographic Society, 17th and M Streets, N.W., Washington DC 20036; Association of American Geographers, 1710 16th Street, N.W. Washington DC 20009.

Please be on the lookout for enthusiastic and articulate youngsters who would like to be interviewed for participation in the Dayton '95 Youth Forum. Have them contact me at (718) 983-1416.

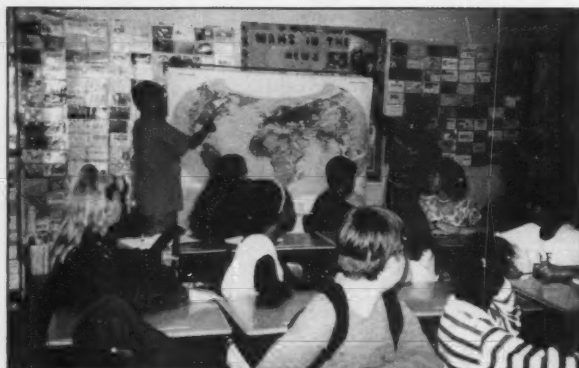


Photo B. Kids like to go to the wall map to pinpoint the location of the voice on the radio.

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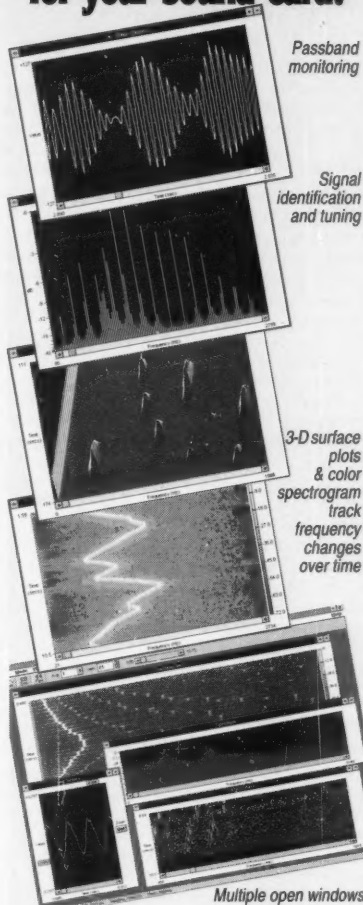
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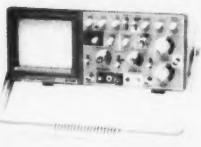
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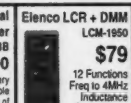
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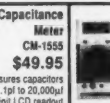
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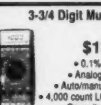
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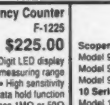
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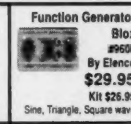
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### T-Hunting Down Under

December already! Another year is almost over. Are you going to let 1994 end without experiencing at least one hidden transmitter hunt? If my correspondence is any indication, 1994 has been the busiest year yet for radio direction finding (RDF) enthusiasts. In large cities and small towns, hams are discovering the fun of these contests, which are sometimes called foxhunts or T-hunts.

In many parts of the USA and Canada, cold weather has halted foxhunts until spring. In some cities, such as Montreal, snowy weather is no deterrent, and regular hunts continue. With no snow or freezing weather here in the metropolitan parts of Southern California, we hold more than two dozen T-hunts every month of the year. Wintertime can bring heavy rains, but most hunters keep going like the famous battery bunny. All that is needed is a rainproof antenna installation and mud-ready tires.

#### A Fox on the Barbie?

There is at least one place in the world where a busy w-a-m-weather T-hunting season is just getting started. As I learned in a recent exchange of messages on the Internet, transmitter tracking is becoming more and more popular as a ham activity in Australia. While there are occasional on-foot-only events there, most hunts involve mobiles and pedal-to-the-floor driving.

Bevin Boden VK5TV explained how a typical hunt goes (with my translation in parentheses): "All hounds (hunters) gather at one point and draw starting positions. The fox (hider) departs in his car and is given about 10

minutes start. After that, you are permitted to track and follow the mobile fox. After about another five minutes, the fox goes to ground (stops), sometimes putting the transmitter up a tree, in a bin down a manhole, and so forth.

"After a lot of speeding around with funny-looking aerials, the first hounds arrive. If the fox is in a car parked on the road, it is a quick identification and wait until the next hunt starts. If not, it is out with the sniffer (hand-held RDF) gear and try to find the wretched fox. Sometimes half an hour of people running around like chooks (chickens) with their heads' cut off goes by before the fox is found. The fox has even been one of the hounds in disguise, waving a beam around and supplying strong signals to individual hounds at will."

Sometimes there are several hunts in one evening. It is traditional for the fox team to provide food and drinks for all the hunters after the last round. At this gathering, results are tallied and winners are announced.

The high point of the year for Australian T-hunters is the annual South East Radio East convention in Mt. Gambier, which includes the annual Australian Foxhunting Championships. "Some hams travel more than 1,500 miles to attend," says VK5TV.

Mark Diggins VK3JMD sent a copy of the itinerary and rules for the 1994 championships. There were 11 separate events over a 26-hour period, including sniffer hunts, mobile outings, and even a special on-foot foxhunt just for kids. Mobile hunters had an opportunity to track beacons on ham bands from 3.5 to 1200 MHz. The winner of every hunt was determined by elapsed time, first finder wins. No hunts were scored by odometer mileage, as is often done stateside.

The biggest challenge of the cham-

pionship weekend was Saturday at 8 p.m., when the marathon four-band night hunt began. Foxes keyed down on 2 meters, 10 meters, 70 centimeters, and 6 meters. Marshals kept close watch to ensure that the rules were obeyed. Special rules were crafted with careful attention to detail. For example, one rule stated, "Should it be necessary to leave the vehicle, only one set of RDF equipment is permitted amongst the group from that vehicle. This includes foil under T-shirts."

Information on the championships was just part of the information package that VK3JMD sent about VK-land T-hunting. It also included photos and videos of Aussie hunters in action. Mark lives in Dingley, which is in Victoria, at the southern tip of eastern Australia. He is close to Melbourne, the apparent capital of T-hunting for the country. His club, the North East Radio Group (NERG) is very active in promoting the sport.

NERG member Andrew McColm VK3KIR produced the video to show non-hunters how it's done there. In it, Geoff Hudson VK3VR tells some of his secrets of success on first-finder-hunters. He urges new hunters to start turning their beams and getting bearings as soon as the fox drives away. "If he's been gone 10 minutes and he's as weak as water, the signal will be masked by many reflections

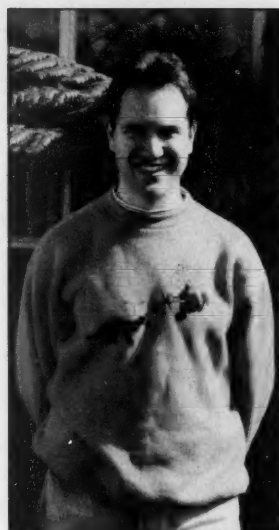


Photo A. Mark Diggins VK3JMD sent these photos of T-hunting in Australia. His sweatshirt (a "wind-cheater," as the Aussies call it) features his original fox-hunting graphics.

and you won't have a clue which way to head."

VK3VR continues, "As you drive out, stick on major roads. For heav-



Photo B. The back-seat navigator on Mark's team uses this computer to plot signal strength readings. His Doppler DF display is underneath.

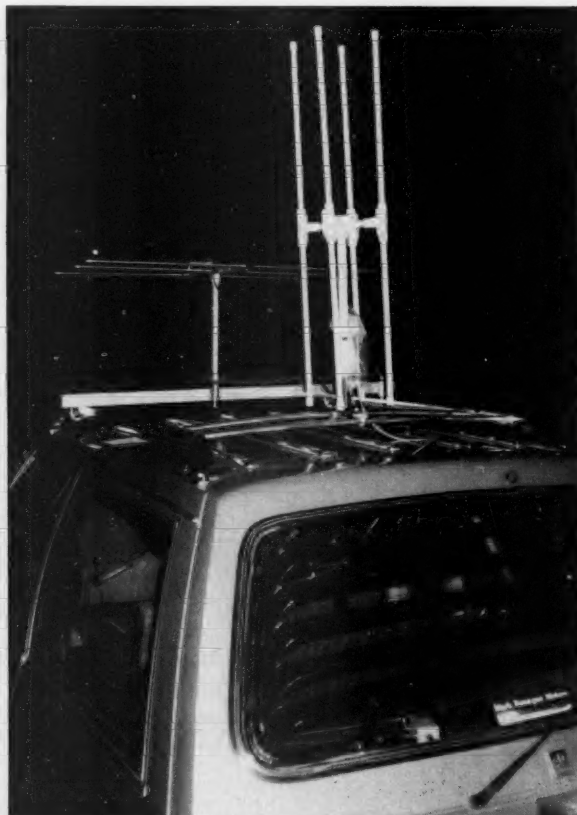


Photo C. The VK3GMZ team hunts on 2 meters with both a horizontally-polarized beam and a modified marine Doppler array.



Photo D. VK3CHR handles the controls for the VK3VT RDF team. The HF receiver operates directly on 10 meter hunts, and as a common intermediate-frequency system with downconverters for hunts on VHF bands.



Photo E. A chain drive controls the horizontally-polarized beam for the VK3YQN team. They also have a motorized spinning quad and CRT display in back.

en's sake don't be pulled into side streets, they'll cut your speed dramatically. Use attenuation to reduce the overall system gain so that you can just hear the signal, thereby minimizing distracting reflections."

To save time on hunts where the fox is not right out on the road, back-seat team members jump out and take off on foot when they think they are within rapid hiking distance of the fox. This practice is called dropping run-

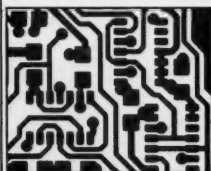
ners. The front-seat hunters then continue, trying to drive closer.

"Don't be tempted to drop runners out purely on the basis of signal strength," Geoff urges. "Just because the signal's getting strong doesn't mean you're close. As you go by the fox, the signal will swing around. Wait until he's behind you—when you have

gone past, you know you're close. Then drop your runners.

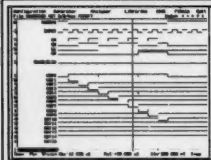
"If you don't have communication to your runners, agree with the guys what you're going to do if they don't succeed. We work on the basis that if a runner can't find the fox, he goes back to where the car dropped him off. Another tip for the runners is to always

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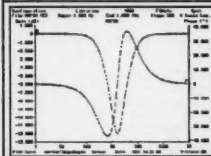
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Photo F. VK3XAJ heads down the road with his 10-element dual-polarized beam on the roof and scope-tube display in the back seat. "He gets lots of attention from the police," says Mark.

carry 30 cents for a phone call. At least you can phone for a taxi to get home if the buggers don't pick you up!"

Geoff went on to tell about the equipment you need to be prepared to home in, such as a sniffer and a torch (flashlight). Since radio foxes often hide on a riverbank, he carries an inflatable rubber dinghy and com-

pressed gas cylinder in the car, in case his team drives up on the wrong side of the river. That play has been foiled, however, when hiders put the T on the bank in heavy brush with thorns.

#### Home-Brew Homers

When April and I visited down under a few years ago, most of the gear

in almost every ham shack we visited was home-built. The Aussies' love of do-it-yourself continues, as you can tell from VK3JMD's Photos A through F. Commercial RDF sets are not readily available as they are in the USA, so each team has developed its own creative collection of mobile gear. Some are quite advanced, featuring motorized directional antennas, computers, and cathode-ray tube displays like those described in recent "Homing In" articles.

"Sniffers" for on-foot hunting usually consist of a sturdy three-element yagi and a receiver with built-in attenuation. A model by Ian Stirling VK3MZ, designed around the Motorola MC3362 receiver IC, is popular with home builders. Some hunters replace the receiver's analog S-meter with a voltage-controlled audio oscillator and speaker. The pitch of the oscillator's tone goes up and down in proportion to the signal level. They call them 'whoopie sniffers.'"

While some hunters employ VHF-FM receivers modified with external S-meters or multimode rigs in the sideband mode, most still prefer to build special RDF rigs. For instance, Greg Williams VK3VT crafted a set with tunable 6 to 8 MHz variable bandwidth IF, noise blanker, and calibrated S-meter in a shielded case. The ruggedly-built cabinet has a rotary RF step attenuator, but for even

more signal reduction when very close it has a switch that open-circuits the antenna input. "Equipment really gets knocked around on a foxhunt," he says.

To encourage constructors, a home-brew competition with judging and prizes is part of the annual fox-hunting championships. There are three categories, novice through expert.

Many NERG foxhunts involve transmitters on three or four ham bands at the same time. With four members on his team, space in VK3JMD's vehicle is at a premium. He wants to replace his small 6 meter loop with a beam antenna for more gain, but he doesn't want to waste valuable hunting time assembling and disassembling the antenna in the field.

"The problem is storing antennas when not in use," he says. "In the back of the Subaru station wagon we carry four 2 meter sniffers, two beam poles, two 70cm sniffers, a 2 meter beam, 70 cm beam, 6 meter sniffer, toolbox, a box of spares, and some other personal stuff. If we add to this a full-size 6 meter quad, assuming we can get it in the car, we won't be able to move in our seats!" To solve the problem, Mark is now building a two-element "shrunk" quad. (See "Homing In," January 1990.)

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## Ski to the T

Though summer is coming to VK-land, foxhunters there don't dread the winter months. In fact, many look forward to T-hunting in the snow. VK3JMD's package included a flier on the upcoming SnowDF, which will take place at the Mt. Buller ski area. SnowDF is simply a series of 2 meter sniffer hunts in the snow.

Contestants can use any suitable means of human-powered travel on the slopes. Vehicles are prohibited, but hunters are allowed to use the ski lifts, if they can convince lift operators to let them on with arms full of RDF gear. Most entrants will hunt as individuals. Hunters may team up, but only one piece of RDF gear per team is permitted.

No hunt boundaries were mentioned on the SnowDF announcement, but it probably covers the entire ski zone, which is quite large. Organizers anticipate that many entrants will not be able to find all of the hidden T's before dark. Their ordinary field-strength meter type sniffers may not be sensitive enough to get good bearings.

On the other hand, large RDF antennas are cumbersome when walking and skiing. Extra safety precautions will be in order when in the snow. Smart RDFers will use antenna elements that are designed to bend or break on impact, and include eye pro-

tection on the tips.

Bearing-taking in the snow will be a challenge. Snowbanks make good VHF signal reflectors. It has been our experience in Southern California that signal bounces from the mountains are always stronger in winter months when the peaks are snow-covered.

Many thanks to Mark, Bevin, and other RDFers who have sent information on local activities. As always, your T-hunting stories and photos are welcome. Send electronic mail to me via CompuServe (75236,2165) or Internet (joemoell@cup.portal.com). Send "snail mail" to the post office box in my byline.

## RDF on the Information Superhighway

When it's 20 below and the snowdrifts are six feet deep, you may not feel like T-hunting in your car or on foot. But you can do the next best thing: Chat about T-hunting. Foxhunters across the country and around the world are online. You can sometimes find them on commercial services like CompuServe, but my favorite place is Fox-List on the Internet. It is sponsored by the Boston Amateur Radio Club and is free of charge, except for your usual E-mail access costs.

Unlike the Usenet ham radio newsgroups, where messages are posted for any Internet browser to see, Fox-List is a special mailing service called

a reflector. After you join the list (subscribe), you automatically receive, at your e-mail address, copies of all messages sent by others to the Fox-List. To send a message to all other subscribers, you simply address it to fox-list@netcom.com. (The hyphen is important.) The server then resends it to all list members.

Fox-List is just like having a worldwide T-hunting BBS, with all postings sent to you automatically. So don't subscribe unless you want lots of messages filling your E-mailbox. Most exchanges are about the technical aspects of RDF. In recent weeks, there have been lively discussions on ad-

vanced Doppler techniques, East Coast versus West Coast foxhunting, and methods for computerized mapping for use with Global Positioning System receivers.

To become a subscriber, send a one-line E-mail message to list-serv@netcom.com from the address where you want to receive your mail. The text is simply "subscribe fox-list" (without quote marks, of course). Then send a short message to fox-list@netcom.com to introduce yourself and describe your local RDF activities. When you see your message reflected back from the list, you will know that you are a member.

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Anyways, here's the goodie's list of companies that cater to the ATV enthusiast:

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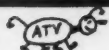
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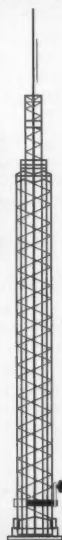
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### Microwave Test Equipment

I am always asked the question, "Why is it that microwave test equipment is so expensive?" Well, most of it was made by manufacturers like Hewlett Packard, Anariden, Anritsu, California Microwave and Frequency West. The initial price tag was quite high as a Mil-Spec item, and this pricing carries over to the surplus arena. Do not despair—these items can be duplicated in an amateur workbench setting in a few cases. The difference between our home-constructed unit and the commercial unit is mainly calibration.

Inexpensive surplus microwave items can be found, but most of the surplus dealers try to push the \$\$\$ amount as far as it will go. That's part of the American way—free enterprise. I have always tried to find things for little or nothing, but even with surplus electronics there is a basic value (for scrap) that you can't go below.

The same goes for the surplus dealer. I am told many times in my bargaining and haggling over the final negotiable price that "You can't romance a junk man!" Be that as it may, these dealers seem to know when you are trying to look the part of "Joe Cool" and in reality are quite excited about some item you discovered. They seem to be able to see the sparkle in your eye and set the price accordingly. All you can do is wear sunglasses or become a good poker-face. Look for bargains and price them as to how they can benefit you without

your having to redesign the entire chassis.

Don't pick up microwave odds and ends without some plan of how to use them. Just because it's a microwave item, don't go head-over-heels for it. Set the proper pace—first determine if the item will fit in with your plan of construction. Of course, if the item is better than any other thing you have, pick it up if the price is reasonable. This is especially true of good mixers/detector mounts, amplifiers and miniature microwave relays. Other items require some thought. Even I take some of this advice and as such do not have a collection of waveguide attenuators. They're nice, but I only need one in the test setup I am about to describe.

### Microwave Signal Generator

There are quite a few simple pieces that work well when assembled and form useful microwave test equipment. The general appearance of these items is not top-notch (finished) but perform their function well, are dependable and the cost is minimal. The little generator that I will describe is quite simple and is just about as effective as some of the very large microwave test generators. Its components are a Gunn oscillator, a waveguide attenuator and a coaxial transition. N6IZW and I both use this style test generator on our workbenches to retune circuitry for 10 GHz. Both low power (preamplifiers) and high power (10 watt TWT) amplifiers have been tested with this setup. My old HP 10 GHz signal generator (klystron generator) now sits idle and serves as the support for a shelf in the shack.

This little Gunn oscillator is quite useful in bench alignment tasks. When

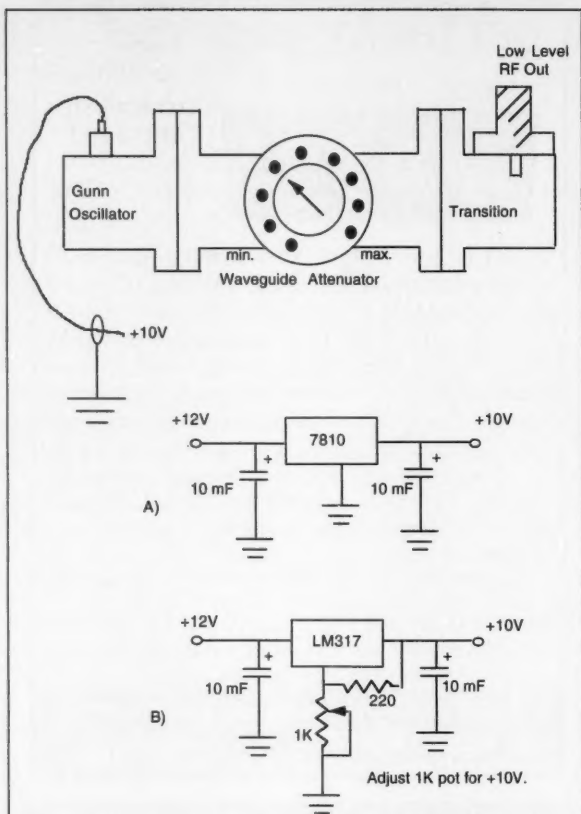


Figure 1. Microwave signal generator/Gunn oscillator power supplies: A) fixed voltage, B) variable.

you stop and think about the 75 lbs. and unstable operation of klystron signal generators, this little adjunct will prove quite attractive. The beauty of this arrangement is that almost any type of Gunn oscillator will work just fine. All you need is some means of connecting a variable attenuator and a transition to a coax connector. Power for the Gunn oscillator can be a battery or a regulated power supply; I generally use my bench-regulated power supply.

The power supply is nothing more than a 9 or 10 volt regulated supply. See Figure 1 for power supply details. A fixed regulator could be used if 10 volts is all that is needed. Some readers might have a Gunn oscillator that requires a voltage of other than 10 volts and they can optimize their circuit with the adjustable LM-317 variable regulator circuit.

The heart of the generator is of course the Gunn oscillator, preferably a low power unit about 10 mW or less. Usually these oscillators use a waveguide flange and are equipped with a small horn antenna in burglar alarm systems. Our conversion is to remove the horn and attach a small waveguide variable attenuator in its place. The output of the attenuator is connected to a waveguide to coaxial transition. This connector on the transition will be our test generator output. Photo A

shows my test generator—that's just how it was constructed many years ago. Variations in attenuator styles are not important; neither is their size. All that is required is that the attenuator be adjustable and have some means of calibration. A logging scale of some sort is quite acceptable. All you want is to be able to reduce power to a very small amount (maximum attenuation) and not override small signal amplifiers with this arrangement.

Cost of components should not be over \$20 for everything. The Gunn oscillator can possibly be scrounged from a burglar alarm company for little or nothing. Check supermarkets and shopping center maintenance shops for door openers that are defective. The Gunn oscillators usually survive; toss the other PC board circuitry away. Waveguide attenuators are a drag on the surplus market and as such don't command a high price. After all, it won't amplify and, other than being scrap brass, it doesn't have much to offer. Three or four dollars seems tops for a good attenuator and adjustable mechanism. You might have to purchase some older WWII radar test set to obtain all the parts. Look around at swap meets and be frugal.

The transition from waveguide to coaxial should not cost more than five dollars in surplus. If you can't locate one, construct one out of a coaxial

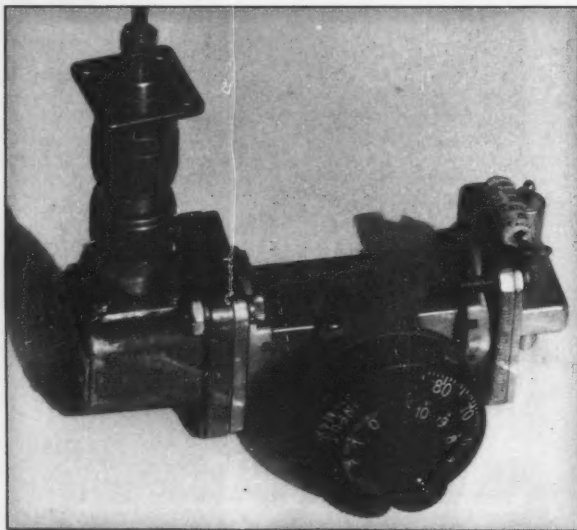


Photo A. WB6IGP's test generator.

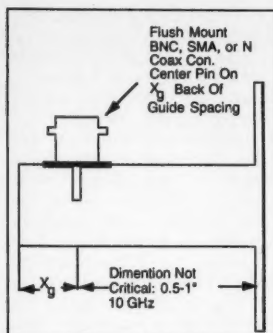


Figure 2. Waveguide transition.  $X_g = 1/4$  guide wavelength at frequency. (10 GHz = 0.2")

connector and some scrap brass waveguide. Only an inch of waveguide (same size as the attenuator and Gunn waveguide flanges) is required. See Figure 2 for construction details; dimensions are not critical. Position the coaxial connector on top of the waveguide section with the rear of the connector shoulder just about at the end of the waveguide. Note where the center conductor is located on the top of the guide and drill a large hole to accommodate the connector sitting flush on top of the waveguide.

Drop in your "N" connector and solder to the top of the guide (other con-

nectors are suitable). Place a brass plate on the rear of the waveguide to close off the end of the guide and solder it into place. We want this end of the waveguide to be closed off with the center conductor of the coaxial connector spaced  $1/4$  wavelength from this rear wall, which is a shorted piece of waveguide (read or end of the guide). The front of the guide—the open section—is fitted with a small brass flange which is soldered into place over the end of the open waveguide. Keep solder out of the inside of the waveguide as much as possible as it's very lossy at microwave frequencies. Finish off the front of the transition by making the waveguide flange constructed "FLAT."

Don't use a file for other than rough finish of this section of waveguide. It is very important to have close tolerance waveguide sections butting up to each other without small cracks—the microwave RF will leak out of poorly-fitted flanges. To make the flange flat, place some medium sand or emery paper on a small piece of glass and rub the face of the flange on the emery-papered surface. In a very short time you'll see high and low spots that need further attention before it becomes flat. In no time at all it will look quite flat and somewhat polished. The Glass flat I use is 6" square and  $1/4$ " thick. I used a thick piece of scrap so the small glass would not be

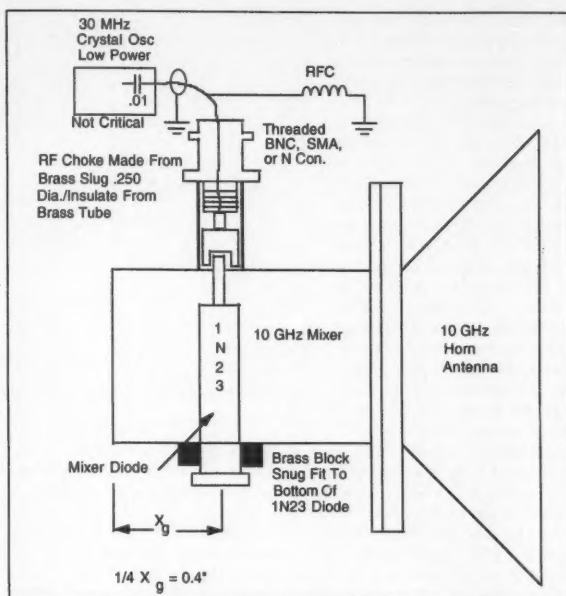


Figure 3. Microwave detector, 30 MHz "Boomerang" reflection antenna. Brass tube size to fit BNC, brass choke 0.259 long with hole to fit 1N23 diode with other end soldered to connector. Insulate with Scotch tape from brass tube, diode bottom grounded in brass block.

very fragile. Back up the glass with a piece of wood or newspaper on a tabletop.

The Gunn oscillator and attenuator and transition are all bolted together, forming the test signal source. Set the

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attenuator to minimum power and determine attenuator range. For instance, if you are working on a receiver preamplifier you might need maximum attenuation of 40 dB or so to prevent overloading a preamplifier. Once you get preliminary alignment of an RF preamp, more attenuation might be in order. In the case of the multi-stage preamps (three-stage), they can have 26 dB gain and as such require the minus 40 dB of input power to provide meaningful adjustments. You cannot adjust an overloaded amplifier; it's all mush in this case. It's better to under-drive a preamp or amplifier stage in the preliminary adjustment stages to be able to see small amounts of gain as you tune the circuitry.

Remember, RF preamplifiers work in the very low dB range on the input of an antenna. At 10 GHz (or any frequency for that matter) minus 105 dB is the equivalent to 1 microvolt sensitivity. Zero dB is 1 mW of power, and a 10 mW-Gunn oscillator puts out +10 dB. For reference: 100 mW of power is +20 dB, 1 watt is +30 dB, and 10 watts is +40 dB. Set your attenuator accordingly to the test amplifier you are working with. I am working on retuning the Qualcomm 14 GHz 1 watt power amplifier a level of about minus 15 dB seems about right. (Amplifier boards are described in the June 1994

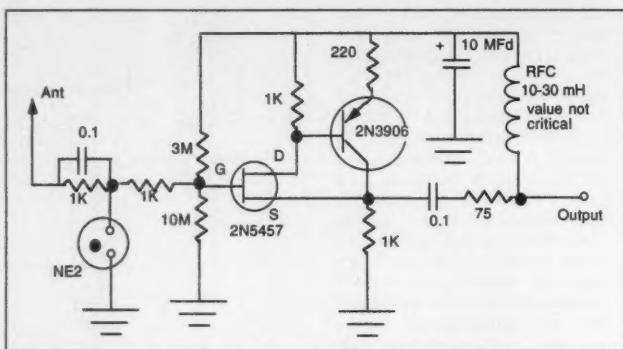


Figure 4. Schematic diagram VLF active antenna amplifier. Mount preamp at base of vertical antenna. Length of antenna is 10 to 20 feet.

"Above and Beyond" column).

Normally, the 14 GHz amplifier requires about minus 5 dB to provide full 1 watt output, but when retuning, reduce the level to prevent saturating stages with RF. Stages that are in saturation do not show tuning adjustments at all. With lower power drive in the -18 dB or so range, small tuning increments are very apparent. This is one topic I will get into next month in detail, after you have had a chance to put the test generator together. Both Kerry N6IZW and I use this method on our workbenches to align or convert circuitry for amateur use.

#### Diode Detector Mount

Another simple test adjunct that can be put to use in the kit of tools for microwave circuitry is the diode detector mount. This single device can be used in quite a few applications, all very useful. You can make a field-strength meter or relative power meter, or a boomerang for wideband FM test alignment. The basic detector mount is a microwave diode (usually a 1N23) housed internal to a short transition-like holder that is fitted with a coaxial connector. Usually the coaxial connector on a detector is elevated somewhat from the waveguide to al-

low room for the diode connections. Figure 3 shows a typical diode detector. The small tower contains connections between the diode and an RF choke and the connector center connector.

The RF choke is nothing more than an insulated metal sleeve made from brass. Its impedance, at 10 GHz, is very low, making it an RF choke, but at say 30 MHz it's invisible, save for a few pF of capacitance. Its job is to remove 10 GHz energy and allow the IF frequency to pass. One side of the diode connects to the bottom of the choke and the coaxial connector center connector connects to the other side. The side walls are insulated with mylar or scotch tape. I have constructed detector mounts with copper pipe for the short tower section, drilling holes in the RF choke top and bottom to fit the top of the 1N23 and the coaxial connector center conductor. Adjust dimensions to allow the pin of the connector and the tip of the diode to make a good connection when all is held together.

Insulate the RF choke and make sure nothing shorts out the diode and RF choke connection. It's all above ground. The other side of the diode is grounded in a tight fit. Whether you purchase a detector mount or construct one, both should work well in these two applications. First, a simple

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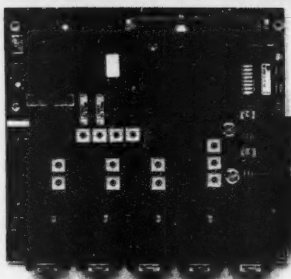
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detector can be constructed by placing a microamp meter from the detector output to ground. It will respond to incoming RF and give you a simple test of relative RF. For increased sensitivity, connect a single-stage amplifier for more sensitive meter indications.

A single 31:30 op amp will do the job. See Figure 4 for schematic details for the amplifier stage. Construction is not critical and can be dead-bug style on the back of your meter to keep the size small. I placed mine in a small metal box to prevent stray interference, and mounted the detector on the output flange of a waveguide frequency meter. I use this setup to calibrate 10 GHz wideband FM Gunn oscillators to proper frequency.

#### The Boomerang

The detector mount can also be utilized to construct a reflection signal test set. It's been called the "boomerang," and in function it does just that. It reflects a microwave signal back to the source of radiation, but not like a mirror: It will translate your frequency back to your receive frequency. This assumes you are using a 30

MHz IF. If you use other frequencies, change the crystal oscillator to suit your IF frequency.

A boomerang is nothing more than a detector mount at the microwave frequency, to which is coupled a source equal to your IF frequency. In this case, using a 30 MHz IF, a simple 30 MHz TTL-type crystal-can oscillator, will work just fine. High power on the oscillator is not necessary. A feed directly from the oscillator coupled with a 0.01  $\mu$ F capacitor will work well. Tie the detector diode to ground return with a 30 MHz type RFC. The value is not critical.

What happens is that when you aim your 10 GHz wideband FM transceiver at the boomerang it detects your incoming RF and mixes it with the 30 MHz oscillator, generating a difference frequency, and reflects that mixed frequency back towards your receiver. If your receiver is sensitive enough and you have not placed the boomerang too far away, the receiver will detect it. As you make sensitivity adjustments in the receiver or antenna system you will see a higher return signal for your efforts. A single station can use the

boomerang for system sensitivity evaluation or antenna aiming tests.

#### Update: VLF Active Antenna

At present, several simple schematics have surfaced concerning active antennas to be used in the 100 kHz range. Figure 4 shows the simplest type—an FET input to match the very high impedance of a short wire or whip antenna at 100 kHz. The FET is connected in a Darlington configuration with a small-signal PNP transistor. The circuit is set up not for a lot of gain but rather for impedance matching of the very high impedance whip antenna.

A 100 kHz antenna with a feed impedance close to 50 ohms would be 1/4 wavelength long. At 100 kHz you would need a weather balloon to loft that piece of wire. As the length is shortened the impedance increases, and with a very short piece of wire the impedance is very high, requiring matching. The neon bulb, an NE-2, is in the circuit to short the input with high RF input surges like lightning, to protect the amplifier.

Construction is not critical. For best performance, the amplifier should be

mounted at the base of the antenna, being powered from the Loran receiver, which feeds 9 volts DC up the RF coax. An alternate antenna for a quick test is a 20-foot vertical wire or whip tied directly to the receiver. It works for a quick test if signals are strong. This is by no means the last word, but a report on one version of an active antenna for VLF use.

You might want to know why coils are absent from this design. Well, with LORAN pulse operation, any tuned circuit not broadbanded enough would impair the pulse nature of LORAN signals. In other words, a sharp filter-like circuit would cause the receiver to be inoperative.

Well, that's it for this month. In the January issue I plan to describe switching-type power supplies used to power numerous circuits requiring voltages greater than 12 volts. Circuitry will be discussed that will allow you to operate 15 to 24 volts of any polarity from a negative grounded 12 volt battery. As always, I will answer questions concerning this and other related subjects. Please send an SASE for prompt response. 73 Chuck WB6IGP.

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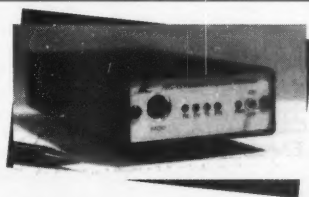
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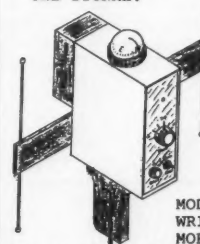
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### Troubleshooting Kits

Since this month's theme is kit-building, I thought it might be fun to take a look at the process of fixing those kits. At first thought, it might seem as if servicing a kit would be no different from repairing anything else. There is a difference, though, because with a piece of commercial equipment, you know that it once worked! With a kit, you have no such guarantee. Also, with factory-made gear, the quality of construction is expected to be at least fairly good. (Of course, that isn't always the case!) With kits, the construction can vary from great (you built it yourself, and you never make mistakes) to atrocious (that guy at the hamfest said the guy he got it from had a 12-year-old nephew whose friend put it together). So, how do you start when you're confronted with a dead kit?

#### Who Made-a de Radio?

Well, who *did* build the darned thing anyway? If you did, you're way ahead. At least you know you didn't put any parts in backwards, or make solder bridges, or leave something out, or misread the color code and put a 100k ohm resistor where a 1k ohm part was supposed to be. What, you aren't so sure about that? Surprise—you're not alone. In fact, lots of experienced, competent kit-builders make mistakes they'd be shocked at if someone else made them. It really pays to go back over the thing, step by step, until you have eliminated human error from the possibilities.

The best way is to pretend to build it all over again. Get the instructions and start from step one. OK, you don't need to inventory all the parts. It wouldn't hurt, though, because your unit's trouble could be due to an incorrect part that came with the kit. If you didn't notice it the first time, you might catch it now. And, from what I've seen and heard, most people don't bother to do the initial parts inventory anyway. So, I take it back; you *should* check that each part called for is the same as the one actually there.

OK, they're all present, but did they wind up in the right places? Inadvertent swapping of components is a big cause of kit failure. Check each part, paying particular attention to resistors, because of the color code issue. It's very easy, even for experienced techs, to make errors, especially on the multiplier band. No one is likely to mix up a 4.7k ohm resistor with a 33k, but the only difference between 10k and 100k is that the final band goes from orange to yellow. I don't know about you, but I sure have made that mistake when the light wasn't bright; the two colors just aren't that far apart.

Check also that capacitors haven't gotten mixed up. Most kits' schematics specify caps in the standard American format, such as 0.1  $\mu$ F or 100 pF. But, lots of parts come in the Japanese format and have markings like 104. What's a 104? That's a 0.1  $\mu$ F! And 103 is 0.01  $\mu$ F, and so on. Unfortunately, kits containing such parts often have no mention of the different markings in the instructions. The same problem can exist for inductors, but not that many inductors are marked using the Japanese system.

Another common cause of kit problems is reversed components. Polarity isn't an issue, of course, with resistors, non-electrolytic capacitors and most inductors. But, with electrolytics and semiconductors, it's crucial. An incorrectly oriented transistor, diode or integrated circuit just isn't going to work. With the electrolytic and the IC, the first application of power most likely will destroy the part. Transistors and diodes fare better; often, reinstalling them properly will correct the difficulty with no harm done. But not always. If you see or smell smoke, expect to need some new parts. There's a big secret the manufacturers don't tell you: Electronic parts run on smoke. Once you let it out, they don't work anymore!

If all the parts are in the right places and correctly oriented, why the hangamont doesn't this thing work? Well, the number one cause of all kit problems is poor soldering. It's not hard to learn to solder, but many people just never take the time to learn, or they have no one to teach them. As the number of technically inclined Americans dwindle, the lack of Elmering is getting to

be a serious problem.

So, go over the kit, joint by joint, looking for cold solder joints and, especially, solder bridges. You'll almost never find a bridge in commercially-built equipment, but kits are very prone to this problem. There are three reasons. First, manufactured gear is wave-soldered, not hand-soldered. It's a much more controlled process and, in conjunction with the solder masking on the boards, makes bridges nearly impossible. Second, many kits have little or no solder masking, exposing much more copper to the likelihood of a bridge. Finally, many people don't have the manual dexterity to solder today's tight boards, or they're just plain careless.

Once you're sure the kit is properly soldered, you should be in business. If it still won't work, you're left with some analysis. If you built the kit, then you know its history. If it worked at first and then died, you've got a standard troubleshooting case on your hands. If, though, it never worked, then you can assume a mistake somewhere. Sometimes, those errors can be pretty obscure.

#### Oops, a Mistake

I remember one rather complex Heathkit I put together years ago. It had lots of ICs in sockets. I was very careful over the many hours of construction, and I sure was disappointed when the darned thing wouldn't work properly. After lots more hours of oscilloscope troubleshooting, I found that some of the IC pins weren't making contact inside the sockets. Turns out I had used a little too much heat when soldering them, causing some of the plastic inside to melt and form a film around the little metal receptacles for the pins. Some new sockets fixed it all up. Was it my fault? Maybe, but I'll never be sure. Perhaps they were overly cheap sockets intended for wave soldering. I don't know.

While I'm strolling down memory lane, I recall another kit I made. This one smoked big time when I plugged it in. I was very upset, assuming I'd done something terribly wrong. It turned out that the power transformer was completely shorted. A call to Heathkit brought another transformer in a couple of days (how's that for service?), and the unit worked fine. I miss those people.

#### I Didn't Do It

If someone else built the kit, you

have no idea whether it ever worked. For that reason, I often avoid buying used kits at hamfests. But, if you do buy one, take a good look at it. If it's very new but doesn't work, it's a safe bet it never did. If it's older, it probably did work at one time and died later. Also, the quality of construction should be obvious. If the soldering looks lousy, or the unit is covered with yellow tobacco tar, you're in for a real job. (I don't know why those two things so often go together, but I've seen it time and again. Perhaps people who won't take care of their own bodies also don't take care of their equipment.)

Whether the kit ever worked or not, consider that it may have been improperly adjusted. That's especially true with radio equipment, which often has lots of oscillators and tuned circuits to adjust. Even in commercial gear, the consistency of adjustment leaves a lot to be desired. With home-built gear, it's almost a given that the thing will be at least somewhat out of whack. So, while I always strongly suggest that people not diddle with their commercial radios' adjustments, the opposite is true with kits, especially when you don't know their origin. Some of those old Heathkit receivers can seem quite dead if they're out real far, and a few quick turns of some coil slugs can bring them back to life in a jiffy. But, don't start doing that unless and until you are quite sure nothing else is wrong. Also, don't do it unless you have the manual and whatever test equipment is required to set things right. Otherwise, you run a great risk of making things worse than they already are, with no way to undo the mess.

#### Do It!

If you've never home-brewed anything, a kit is a great way to start. Even if you've built lots of things, kits can be fun, and they also can get you things you want at reasonable prices. In particular, there's lots of QRP gear available in kit form, and it's very nice. Frankly, if I wanted a small QRP transceiver, I'd rather build one from a kit than start from scratch. What the heck, why reinvent the wheel when somebody else has already figured out a good one?

So, I wholeheartedly recommend kits. Just remember, when you're faced with a broken one, some of the troubleshooting rules are different. Until next time, 73 de KB1UM.

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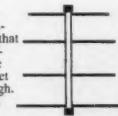
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## Notes from FN42

It's that time of year again as I sit down to write this month's episode, my semiannual pilgrimage to Hosstraders in Rochester, New Hampshire. It's a happening, a fun time, time to greet old friends and meet new ones, check out the new gear and the old "boat anchors," and wish that you had brought more money for those treasures that they just don't make like that anymore.

It's an outdoor event, with the commercial interests located inside buildings. It can be hot (in the 80s or 90s in May) or below freezing at night in October. The sun can be shining brightly all day (bring the sunscreen), or there may be blowing rain, sleet, or snow. It doesn't make any difference—there will be thousands of dedicated hams lining up at the gates to enter.

And last, but not least, one of the best reasons to attend is that all the proceeds (beyond expenses) go to the Shrine Hospital in Boston. All entrants give the money directly to the Shriners at the gate, and many of them are your fellow hams.

Before we continue on to the latest in the happenings around this great world of ours, my hearty congratulations to Hans van de Groenendaal ZSSAKU for his appointment as the IARU Satellite Adviser. Hans has contributed information from South Africa as 73 Ambassador and as a satellite contributor. I'm sure that he will do a great job for all of us in this post.

More news next month from Lorbie DU1CHD, Cho Byong-Joo HL5AP, and whatever else shows up in the mailbox.

## Roundup

**Australia Submission by Richard Murnane VK2SKY:** "DX-ING WITHOUT PREJUDICE" or "The Carefully-Worded QSO."

I cast a bloodshot eye toward the station clock. 18:35 UTC. Just gone half-past four in the morning. I couldn't let go, not just yet.

It had been a good night for DXing. Despite the generally declining conditions, 20 metres had been open to all continents, and I had made the most of it. Several hundred logbook entries, each harder to read than the one before, but there would be a good haul of QSL cards out of that lot. Not bad for one night's work.

As dawn approached, the bands had closed, and my eyes felt ready to do the same. My last CQ had gone unanswered, and a final listen around the band turned up nothing but background noise, hushing me to sleep...

As I reached for the power switch, a

lone voice appeared, calling in the wilderness. Had it been something mundane, like a JA or a W6, I would probably have let it go, but it was an unfamiliar prefix: L1. Now, where the heck was L1? Perhaps one of those new Yugoslav republics... I'd check later. Hmm, and he was operating portable. Not a bad signal, considering. I returned his call.

"L1TIG/8, this is VK2SKY. You're five by four in Sydney, Australia, over."

"VK2SKY, I think it was, you are five by three here. The name here is..." He broke off. After a long pause, he came back again, somewhat hesitantly, "umm, I mean, without prejudice, your signal is five by nine, I think."

This took a moment to sink in... there was no fading on the band, so the dramatic change in the report was a bit of a surprise. But that curious phrase, without prejudice, what did he mean by that? Perhaps I had misheard him. I resorted to the old trick used by every Amateur who gets caught not paying attention; I blamed it on QRM. Before I could pick up the microphone again, another station came on the air.

"Break—This is L1BEL... the VK station, you're a good 59+20dB at my QTH. It appears that the other LI is experiencing a temporary technical problem with his station. I can see no other reason for his allegation that your signal was any less than perfect, old man..."

For a moment, I was speechless. Then, yet another new prefix, a CØ, broke in.

"Break—I object to the age-ist and sexist language used by L1BEL... 'old man', indeed! The VK, if you wish to pursue the matter through the courts, I think you have the makings of a pretty solid legal case... CØURT on the side."

I had no idea what the last station was on about, but I was suddenly wide awake, frantically searching for my pen to write down all these new call signs. I scrambled among the callbooks and notepads before I finally found it. I started scribbling, but as Murphy would have it, the pen wouldn't write.

"All stations from VK2SKY, please stand by, my biro isn't working..."

Suddenly, all three DX stations howled back in unison, **THAT'S DEFAMATORY!**

I blinked, several times. What had I said?

A new voice chirped up (D3FAM, I think), "You should be aware that 'Biro' is a registered trademark. Your inference that the products made by that company are defective in any way leaves you wide open to prosecution under international law. What kind of Amateur are you, anyway?"

"I... I..." What answer can any Amateur give to that one?

"D3FAM from CØURT, just what are you implying? Your last comment has defamatory implications as well, so watch your step."

"Hey, you can't threaten me on air—that puts you in breach of ITU regulation number... um... hang on, I've got a copy of them right here. Stand by one..."

"L1BEL here. I think we're getting off the track... We haven't resolved the issue of L1TIG/8's derogatory signal report to the VK station. It implies that the VK's ability to maintain the technical standards of his station is less than satisfactory, not to mention the totally unjustified criticism against... uh, the VK, what make of rig are you using there?"

"Yaesu," I replied, as a dull throbbing developed around my temples.

"... yes, against Yaesu. Now we all know the good standing of Yaesu in the area of field of Amateur communications, but here we have L1TIG/8," he paused for breath, *allegedly* saying words to the effect that the VK's equipment is performing badly, due to some unspecified failure of the manufacturer to adhere to generally accepted principles of industrial quality control, and/or the failure of the VK station to operate the equipment in accordance with the manufacturer's directions. It appears that L1TIG/8 is calling the VK an idiot and, in my opinion, the VK has an excellent case..."

"Hey, look, I never sa..."

"Charlie Alpha Five Echo here—did somebody call me?"

"Hey, CA5E's jamming the LI station. There's potential there..."

"You mean, it appears that CA5E is jamming..."

"Yes, of course, thanks for that..."

"No problem. I'll send you my bill."

"Get lost! I didn't as for your advice."

"True, but you accepted it. By implication, we have a contract..."

"We do not!"

"L1BEL from TØRT, it sounds like he's calling you a liar, and we all know that..."

Once again, they all chorused, **THAT'S DEFAMATORY!**

"Hey everyone, I've got a JA on the packet cluster who says he works for Yaesu's legal department..."

"Allegedly works for..."

"Before I acknowledge that last station, how much is it going to cost me?"

"Break from TR1AL... can I remind you all that it's illegal to conduct business on the Amateur bands?"

I felt I was now on shaky legal ground coming back on the air... for a while, I considered taking legal advice, but it was still too early in the day to call my solicitor. Instead, I lapsed into a troubled sleep. When I awoke, 20 metres was once again a jungle of static.

Later that day, I finally threw away my copy of *The ARRL Handbook*, and took out a subscription to *The Australian Lawyer*.

[The end—usual disclaimers, all call signs (except mine) are fictitious,

any similarity, etc., etc.]

Sent in by Richard Murnane VK2SKY, 7/15 Grafton Crescent, Dee Why 2099, previously published in his local ham rag, "Amateur Radio Action."

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Subject: IARU APPOINTS SATELLITE ADVISOR

HR AMSAT NEWS SERVICE BULLETIN 274.01 FROM AMSAT HQ SILVER SPRING, MD OCTOBER 1, 1994

TO ALL RADIO AMATEURS BT IARU Appoints Satellite Adviser

In a news release dated 26-SEP-94, the International Amateur Radio Union (IARU) announced that it has appointed Hans van de Groenendaal (ZSSAKV) [73 Ambassador to South Africa and regular contributor] to the newly created post of IARU Satellite Adviser. According to the IARU release, the principal task of this position will be to keep the IARU Administrative Council informed on all technical and operational aspects of the Amateur Radio Satellite Service in order to enable the Council to adopt appropriate policies to advance the interest of the Amateur Satellite Service before the International Telecommunication Union (ITU) and regional telecommunications agencies.

The IARU release noted that ZSSAKV, as past President of Southern African AMSAT and an Executive Committee member of IARU Region 1, brings many years of satellite-related experience to this appointment. The IARU release further noted that the appointment is a direct result of recommendations made to the IARU Administrative Council by the IARU Ad Hoc Satellite Advisory Committee, which took up the interim report at the recently completed IARU Administrative Committee meeting in Singapore. The IARU release commented that this action is "tangible proof" of the IARU's interest and involvement in the Amateur Satellite Service.

The release continued by citing IARU's many-year role in protecting the Amateur Satellite Service, in particular its work during the 1979 World Administrative Radio Conference, which led to most of the present Amateur Satellite Service frequency allocations.

The IARU release also stated that the "exponential development of new technologies and ever increasing complexity of the Regulatory Agencies, the IARU Administrative Council deemed it necessary to involve itself closer with the Amateur Satellite Service in order to represent it effectively on a coordinated world-wide basis while cementing its relationship with the AMSAT and other

# Amateur Radio Satellite groups."

In the release, the IARU said that in his new capacity and by the powers delegated to him by the IARU, ZS5AKV will have the task of appointing someone to the post of IARU Satellite Frequency Coordinator.

The IARU said that ZS5AKV is now soliciting nominations for volunteers willing to serve the function of IARU Satellite Frequency Coordinator. Such nominations should be sent to him by FAX at +27-31-765-6456 or via INTERNET at [amsat@uctvax.uct.ac.za](mailto:amsat@uctvax.uct.ac.za) before 31-OCT-94. Hans said that each nomination should include a comprehensive summary of the nominee's background and qualifications. He stated that it is his intention to discuss the various nominations with major AMSAT groups in order to seek their recommendations. He underscored the importance of finding the right person to be appointed to this very important job.

## AUSTRALIA

David Horstall VK2KFU  
P.O. Box 257  
Wahroonga NSW 2076  
Australia

The "hot news" in Australia is that licence fees are no longer payable for CB Radio (known more formally as the Citizens Radio Service). What has this got to do with Amateur Radio? Well, it seems that the regulatory body—the Spectrum Management Agency (SMA)—has to make up the shortfall somehow, and rumours are abounding that all "fixed" radio sites (e.g. Amateur repeaters) will attract a fee of AU\$800! Naturally, I will report on subsequent news in a future column.

There is some concern that offensive and possibly defamatory messages can be distributed via the packet radio system, and it appears that the "Sysop" of every BBS in the path can be held responsible. The Wireless Institute of Australia (WIA) is looking at this problem, with a view to making a recommendation to the SMA (before they do it for us). It is likely to involve some form of authentication at the originating BBS, and the system in the USA (where only the first BBS is responsible) is being looked at. It is a shame that such measures are deemed to be necessary, but it seems to be a reflection of society as a whole.

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW.AUS.OC" and "dave@esi.com.AU" respectively.

## PEOPLE'S REPUBLIC OF CHINA

Rick Nui BZ1QL  
Room 316 Building 25  
Tsinghua University  
Beijing 100084  
People's Republic of China  
KATMANDU . . . A goodwill package

of RTTY Digital Journals was airmailed to the Nepal Amateur Radio League (NARL) from TUARC in early August, relaying our "good luck" message to the developing 9N1 amateur community. Satish 9N1AA has been active on these days and is also the key person getting things going in NARL. He can be reached via digital as 9N1AA @ JASTX.JPN.AS or by airmail at PO Box 4292, Katmandu, Nepal.

HAM EXAM . . . The first-ever national Amateur Radio License Examination was held July 10 and 17 in Beijing, Shanghai, and other big cities. Thousands of people participated in the exam, and every testee must be a formal member of CRSA, the Chinese Radio Sports Association. Four different classes of licenses are available this time, with Class 3 (CW/SSB) the highest. A good number of BG licenses may be released soon.

AMP & MIKE . . . Right now we are in dire need of a 70cm amp for satellite uplink and a Yeasu microphone that fits the FT-726R transceiver. Both amp and mike presently used are malfunctioning and are hard to repair. We would appreciate your aid or donation to help China obtain a satellite of better quality.

STATS . . . As of September 3, 1994, BY1QH has worked a total of 309 stations in 37 countries on satellites.

TUARC can be reached via any of the following paths: Pager—204-6677 beep 5552 (local only); Digital—BZ1QL @ JASTX.JPN.AS; Internet—[bz1ql@jastx.bbs.arasmith.com](mailto:bz1ql@jastx.bbs.arasmith.com) or [bz1ql@jastx.bbs.lbc.com](mailto:bz1ql@jastx.bbs.lbc.com).

## MONACO

Daniel Plett 3A2LZ  
B.P. 349  
MC 98007  
Monaco

Greetings from Monaco. This summer has seen a wide variety of ham

activities in the Principality, especially with visiting amateur radio operators. F1IXQ and F1RWD came and very ably ran a long weekend of satellite operations from Monaco. They were fortunate enough to have a friend from their CB days who had somewhere to put some antennas. In spite of tall surrounding buildings and quite noisy conditions, they kept a reasonable rate of QSOs flowing. They had a rather attractive QSL card printed for the occasion.

OE7HPI came and operated mobile, handing out QSOs on 40 and 20 meters. W5ZPA came with the intention of operating RTTY and helping a number of U.S. hams add Monaco to their list of countries worked on RTTY. Unfortunately, he was not able to get the gear operating correctly on RTTY and resorted to operating some SSB and CW.

When Monaco hams visit the U.S. we are always asked for three types of contacts: 1) Monaco on top band; 2) a YL contact; and 3) a RTTY contact. Top band is quite difficult, primarily because it is difficult to put up any kind of antenna for 160 meters. There are a few 3A hams who have RTTY gear, but to my knowledge, I am the only one active on RTTY. A YL contact is another story. Most of the YLs licensed in Monaco have VHF-only tickets. The few

who have full privileges don't like the heavy pileups when they operate. For a long time I have offered European YLs help getting on the air here if they come. It looks now as if a YL from the U.S. will come and operate for a little while towards the end of October.

Finally, I regret to inform you of the death of Jean Bardos 3A2EE. "Echo Echo" was one of Monaco's best-known hams and was very active on a wide variety of modes. He was a long-time member of the council of the A.R.M. and will be deeply missed. Best 73!

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# NEVER SAY DIE

Continued from page 4

Heck, I've visited all of these countries, have operated from most, have friends there, and still there are a couple I'd have to make an educated guess on the capital. Well, what did you expect, something easy like Paris or Montevideo?

Step one is to get your Advanced license. Step two is to move your family to some place where you can put up a nice big tower and a beam. Remember what's important in life. You're going to need a kilowatt, however a home-built linear or one bought secondhand will keep the cost down. Linears are easy to build. Then, you're going to need to have your own business so you'll be able to take time off when the bands are open or DXpeditions are on.

Sure, you can work 'em with 100 watts and a dipole, but you'll be trading a bunch of time for your chintziness. For instance, when I operated from Kabul I could hear the Big Guns almost every night. The kilowatts with tri-band beams came through about ten nights a month. The 100-watters could only be heard one or two nights a month.

Worse, when your signal is weak and you're fighting hundreds of other equally weak DXers, you are unlikely to get more than a signal report. It's no fun for someone in a rare country to try and hear your puny signals for long contact.

I remember visiting Mike Ercolino, the president of Telrex Antennas. He had a Collins KW-1 rig and one of his big Telrex antennas. He called CQ Burma and we sat and listened to several XZs answering his call. I was impressed. Little did I imagine that ten years later I'd be visiting these hams. If you can get a four-element 20m beam up around 70 feet, and put a pair of shoes on your rig, you too can have 'em answering your CQs from rare spots around the world. And you can actually sit there and have real conversations with some fascinating people.

The hard part is getting a good location. You're never going to be a Big Gun if you live in an apartment. You need some room for that tower.

## Ho Ho Ho

Yes, kindly Santa, that cheap old codger, will be around, nagging you to give presents in his name. Well, it is the time of year to remind friends that you haven't yet won that coveted QST Silent Key Award. You're probably expecting me to suggest you take care of this with twelve monthly reminders of your thoughtfulness, namely a gift subscription to 73, right? Hmm, if I'd thought about it, that would have been my recommendation. I'd have mentioned that I have a choice for you, the el cheapo gift subscription, which is \$19.97, or the deluxe gift subscription, which is

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Figure 1.

\$24.97. Your choice. They get the same magazine either way. This is just a test of how cheap you are. If you've read any of my travel booklets you know how thrifty I am. Thrifty, not cheap.

There's another gift you might consider for your ham friends. This is the first compact disc of ham music. Ham music? The songs were written and sung by Andrew Huddleston and Lissa Ladefoged, OZ1ADL and OZ1XY, and they're good. Darned good! There's one on DXpeditions, another on Morse Code, and the XYL's lament that he's "Always on the air." Andy says, "I'm not climbing up the

zine threatened to sue them, so they had to change it at the last minute. I wish they'd called it "73." Maybe their next CD will go that route. The disc is by Last Resort Records. You'll be able to buy it direct from Last Resort, or from Uncle Wayne's Bookshelf.

Now, let's get the CD and start sending the digital information on the CD over the air. Yes, it's legal to send music over the air . . . if you do it digitally.

## Incentive Licensing?

Since "Incentive Licensing" was the biggest disaster to ever hit ham radio, with the fallout still being felt, I

licensing" that did the damage, not the actuality. It all started with an editorial in the February 1963 issue of QST which said that the League felt something was wrong with amateur radio and something ought to be done about it. They didn't say what was wrong exactly, so there was no way to argue. The implication was that by going back to the pre-WWII licensing system of two license classes, A and B, that the problems, whatever they were, would be fixed. This all came about when the Hudson Division director, multimillionaire Mort Kahn W2KR, who actually was running the League after his successful overthrow of General Manager Budlong W1BUD, proposed the change.

The ARRL Board refused to touch this hot potato at their yearly board meeting, putting it in the hands of the executive committee, which was dominated by Kahn. Kahn then sent a petition to the FCC without even informing the board, much less getting their okay. The petition asked that General Class licensees be forced to get an Advanced Class if they wanted to continue to operate on the 15-20-40-80 meter phone bands, as it was before The War. The "incentive" part was that if you wanted to continue operating on phone you had to upgrade. With over 90% of hams operating on phone, this was a devastating blow to the Generals.

Tens of thousands, who didn't want to have to take the test, just gave up and sold their ham stations for whatever they could get. Ham gear was soon going for 10¢ on the dollar, which caused the sale of new ham gear to plummet by almost 90%. This not only put virtually every ham manufacturer out of business, it also killed off over 85% of the ham radio stores, and all this happened in about one year. Blown away were Hallcrafters, Hammarlund, National, Millen, Multi-Elmac, Gonset, B&W, Lakeshore Industries, Central Electronics, Sideband Engineers, Thorndarson, Stancor, and so on. Collins stopped all further development of new models and moved their manufacturing for the military to Japan.

It took five years for the FCC to finally act on the petition. The bitter fight I put up against it in 73 magazine resulted in the FCC taking away only half of the phone bands from the General Class instead of all of them, and this despite tremendous pressure from the ARRL and what was left of their ever-obedient affiliated clubs. The end result was that Generals, if they wanted to work much DX, had no choice but to get their Advanced or Extra Class licenses. That's the incentive of "incentive licensing."

Frankly, I see no good reason today for so many license classes. I'd like to see one license exam which tests for technical knowledge and not code skill, and which would then entitle everyone to use all ham frequencies. I'd like to see ham clubs recruit,

**"I'd like to see one license exam which tests for technical knowledge and not code skill, and which would then entitle everyone to use all ham frequencies."**

tower anymore!" There's one about "The trip to Dayton," where Andrew and Lissa spent their honeymoon at the HamVention. And I loved "Rootuma Bound," another DXpedition song. The music varies from country to soft rock and it's great stuff. Give yourself one of these for Christmas, and then get some for friends. Ham friends, of course. But then, what else have you?

The CD title is "Seek You." They wanted to call it "CQ" but CQ maga-

tend to mention it frequently. And since this catastrophe took place 30 years ago, newer readers are often confused, tending to think it has something to do with the current licensing system, which seems innocuous enough.

I've printed all this stuff before. Many times. But for those who are new, I'll cover the ground again so you'll know more about why the hobby is in the shape it's in today.

It was the perception of "incentive

# SPECIAL EVENTS

Number 26 on your Feedback card

## Ham Doing Around the World

### DEC 3

**GREENSBORO, NC** The 14th annual Greater Greensboro Hamfest and Computer Show will be sponsored by the 76 Group at Greensboro Coliseum Complex Special Events Center, 1921 West Lee St., 9 AM-4 PM. Flea Market, Commercial Booths, VE Exams (pre-register), Computers, more. Talk-in on 145.250(-) and 146.760(-) Contact 76 Group, P.O. Box 7862, Greensboro NC 27417-0862, or call REALTALK, (910) 299-2525. Enter 0076 at the prompt.

**MESA, AZ** The Superstition ARC Hamfest will be held at Mesa Community College Campus, NE corner of Dobson Rd. & SR 60 (Superstition Freeway). For info, call (602) 898-9158.

**NORTH OLMSDED, OH** The North Coast ARC Fall Hamfest will be held at St. Clarence Church, 30106 Lorain Rd., 8 AM-2 PM. Setup at 0600 AM. Vendors purchasing four or more tables may set up Fri. eve. 7 PM-10 PM. Reservation payments must be received (with SASE) by Nov. 26th. Send to Dan Sarama KB8A, 15591 Rademaker Blvd., Brook Park OH 44142. Tel. (216) 267-5083, or connect to the NCARC Packet BBS, "C NO8M" on 145.73. Dial (216) 779-6350 and use the commands: D NCARC/HAMFEST. LOC and D NCARC/HAMFEST.INF.

Talk-in on 145.29 and 224.76 Rptrs.

### DEC 4

**HAZEL PARK, MI** Hazel Park H.S., 23400 Hughes St., will be the location for the 29th Annual Swap and Shop sponsored by the Hazel Park ARC. Admission \$4, tables \$13 (check must be sent, no reservations by phone). Talk-in on 146.64(-) (DART). For info, tables, tickets, write to HPARC, Box 368, Hazel Park MI 48030.

### DEC 10

**FARIBAULT, MN** The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club, starting with registration at 8:30 AM. There will be a Handi-Ham Equipment Auction, Flea Market, Dinner at Noon, and Program. Talk-in on 19/79. Contact Don Franz W0FIT, 1114 Frank Ave., Albert Lea MN 56007.

**JACKSONVILLE, IL** Three major clubs are coming together to sponsor a Superfest at 8 AM in the Turner Jr. H.S. VE Exams, Flea Market. Crafts welcome. Contact Tim Childers, (217) 245-2061. Talk-in on 146.775 Rptr., and on 146.52.

### JAN 8

**MILWAUKEE, WI** The 23rd annual Mid-Winter Swapfest will be held at the

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event.

Waukesha Co. Expo Center Forum from 8 AM-2 PM. Advance reservation deadline is Dec. 23rd. VE Exams; please pre-register. Sponsored by the West Allis RAC. Write with SASE to WARAC Swapfest, P.O. Box 1072, Milwaukee WI 53201.

## SPECIAL EVENT STATIONS

### DEC 2

**SAN ANGELO, TX** The San Angelo ARC will operate W5QX Dec. 2nd 1500Z-2200Z Dec. 4th, to celebrate Christmas at Old Fort Concho. Operation will be in the General portions of the 40, 20, 15m subbands, and the Novice 10m subband. For a certificate, send 9" x 12" SASE to AB5BG, 1210 Ardmore, San Angelo TX 76905.

### DEC 10-11

**BETHLEHEM, IN** The Clark County ARC will operate W9WWI to celebrate the Holiday Season. Operation will be in the General 80-15m phone band, the Novice 10m subband, and on 2m. For a certificate, send QSL and SASE to CCARC, P.O. Box 532, Jeffersonville IN 47130.

**KIMBERLING CITY, MO** The Kimberling ARC will operate NQ0G from 1500Z-1900Z both days (Dec. 10 & 11).

Operation will be from the Port of Lights, a 1 1/2 mi. drive through an animated Wonderland of Lights. This event is being sponsored by Table Rock Lake/Kimberling City Area Chamber of Commerce. Look for them in the lower portions of the 80, 40, 20, and 15m bands. For a certificate, send QSL and SASE to Chamber of Commerce, P.O. Box 495, Kimberling City MO 65688.

### DEC 17-18

**NAZARETH, PA** The Delaware-Lehigh ARC will operate W3OK 1400Z-0200Z Dec. 17-18 from the Christmas City. Frequencies: 3.965, 7.265, 14.265, 21.365 and 28.365. For a certificate, send QSL and SASE to DLARC, RD4, Greystone Bldg., Nazareth PA 18064.

### JAN 1

**LOS ANGELES, CA** The Spanish Int'l Western ARC will operate from Los Angeles CA USA, and from Central and South America 1600 UTC-2400 UTC to celebrate "Feliz Año Nuevo America." Frequencies: 21.340 USB and 7.260 LSB MHz. Listen for Stations N6TOO, KC6GJD, N6TBX/TGB and LU9FAN. For a certificate, send QSL to Spanish Int'l Western ARC, P.O. Box 2082, Seal Beach CA 90740 USA.

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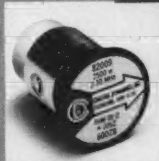
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teach the theory and operating skills, and license newcomers . . . and to be responsible for their recruits. I'd like to see clubs have the power to license and de-license, and get the FCC out of our hair as much as possible.

When we get interested in RTTY we have to learn about it. Ditto satellites, packet, slow-scan, and so on. These interests are an incentive for continued learning.

Mort Kahn's "incentive licensing," which was enthusiastically promoted by Bill Orr W6SAI, was the worst disaster ever suffered by the hobby. It put all the American manufacturers out of business at the right time to open it up for the Japanese to dominate the industry worldwide. Worse, one other result was the demise of over 95% of our school radio clubs, thus stopping the recruiting of teenagers into the hobby. There went the infrastructure which brought us most of our new licensees. Before Kahn's petition, over 80% of our new hams were teenagers. Now it's around 11%. This has stopped over two million youngsters from pursuing high-tech careers who otherwise would have. How much of a difference would two million more scientists,

engineers and technicians have made to the growth of our American electronics industry?

While we were stopping ham growth in America the Japanese were moving in the opposite direction. They introduced a no-code license which allowed 10 watt phone operation on the low bands. This helped spur the

mentals of radio and electronics, just as they do physics, chemistry, and biology. If we can get millions of kids interested in the hobby, we'll not only keep our ham bands, we'll be able to rebuild our electronics industry.

We know that electronics is a key to our success in competition with the other developed countries, yet we're

***"It's my goal to get radio clubs going in schools again, and to get our schools to teach the fundamentals of radio and electronics, just as they do physics, chemistry, and biology."***

development of ham radio clubs in every school in Japan. They soon had twice as many licensed amateurs as we, and with only half our population. This resulted in millions of their youngsters going for high-tech careers, making possible their world domination of the consumer and other electronics industries.

Now stop asking about "incentive licensing." It's my goal to get radio clubs going in schools again, and to get our schools to teach the funda-

doing almost nothing to build the needed high-tech workforce.

**The 73 International Column**

Having visited hams in over a hundred countries, and having DXed from most of them, I'm guilty of trying to force the 73 readers to be more interested in DX than is reasonable. And now, with an ever higher percentage of hams being Techs, the general interest in DX has been falling off, as we've noticed in our reader polls.

When I stop to think about it and put it in perspective, I can understand. DXing is only a small facet of amateur radio, and a good deal of the ops interested in working DX are after DXCC and other awards. Few seem to be really interested in talking with DX ops. Hello, send a card, bye. Thus the low scores for the "73 International" column.

Amie Johnson N1BAC has done a fine job of getting reports from DXers all around the world for the column for the last five years. And before him Dick Phenix handled it, but then he retired to a cabin in the super boondocks. I first met Dick when I visited the San Francisco Mensa group about 20 years ago. He then moved back to New Hampshire and was part of the Mensa group here, where I was the Local Secretary for around 15 years.

I do hope our Ambassadors will continue to send us news of what's going on that we can use in our Letters column. And, if I can get things working smoothly again, maybe I'll be able to visit more of them personally. I still want to visit at least 70 more countries before winning my Silent Key Award from QST.



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CIRCLE 384 ON READER SERVICE CARD

# PROPAGATION

Number 27 on your Feedback card

Jim Gray W1XU  
210 East Chateau Circle  
Payson AZ 85541

I'm sure that you will notice that "conditions" this month leave much to be desired... particularly on weekends. This is due to several factors, which include general decline in the sunspot numbers, seasonal conditions, and just plain chance. You'll also notice that there aren't many days which can be classified as GOOD, so you'll have to make the best out of what's available from the chart. Your best chances are on days that show GOOD or FAIR to GOOD trends. The really POOR days are expected to be the 4th and 23rd, while the rest are trending toward or away from GOOD. If you wish to make the best use of this chart, check WWV at 18 minutes past any hour for their propagation reports and use the information you get which describes today's and tomorrow's forecasted "conditions." Cycle 22 looks as if it may reach its nadir sooner than most forecasters had originally thought, meaning sometime in 1995. That means that Cycle 22 has been a shorter than normal cycle since the last low point of Cycle 21 in December 1986... just nine years instead of the average 11.2 years. Some sun watchers are now saying that the cycles are really 22 years in length and that the 11-year periods are just perturbations in the larger cycle... something I don't yet believe, but am willing to consider. Here's your band-by-band forecast this month.

## 10 and 12 Meters

Only occasional F2 openings to the tropics on GOOD days during daylight hours. Not much sporadic E or short skip propagation can be expected. Skip is where you find it, so keep looking and hoping. Sometimes results are spectacular on a supposedly "dead" band. Really good "gain" antennas can help a lot this month. A good local band.

## 15 and 17 Meters

Fairly good DX into the Southern Hemisphere during daylight hours from noon to sunset local time, and short skip from sunrise to sunset, but expect the band to close soon after—abruptly!

## 20 Meters

Daylight hours should be pretty good for DX this month in spite of depressed conditions in general, and you may even find the band open until midnight. Peaks ought to occur just after sunrise and late afternoon locally. If the band does stay open after dark, look for openings into South America and even Antarctica. Also, during the day, you will find considerable short skip. All of which means that 20 meters should be your PRIME DX BAND. (See 80 meters, too.)

## 30 and 40 Meters

Expect late afternoon and evening openings into Europe and Africa swinging south after sundown for a few hours, but the MUF falls below 7 MHz later in the evening. Short skip

will occur during most days out to 1,000 miles or so, and to 2,000 miles at night until the band closes.

For you newer operators who have not lived through a complete sunspot cycle, there will be some great surprises in store. Listen and learn.

## 80 Meters

This will also be a very good DX band after dark, and since QRN is low, signals ought to be very readable... even weaker ones. Peak DX occurs around midnight local time and just before sunrise. Insomniacs will love 80 meters this month. Short skip at night will occur frequently out to 2,000 miles. Isn't it interesting how two of our "oldest" bands, 80 and 20, are the best in these times? The old-timers knew what they were doing when they "got" these bands for amateurs way back when.

## 160 Meters

You "top band" operators will love this band in December: DX openings to the east from your locations, peaking around midnight (Europe, etc.), and toward the south and west before sunrise. Nighttime short skip should also be good from dusk to dawn, getting longer later. On this band, use vertical antennas to transmit and horizontal antennas for receiving, preferably Beverage antennas if you have the room. Low noise and minor static will make you happy.

## EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA												
ARGENTINA	20	40	40	40	80	80	20	20			15	15
AUSTRALIA	20	20	20	40	40	20	20	20	15	15	15	15
CANAL ZONE	15	20	20	40	40	20	20	15	15	15	15	15
ENGLAND	20	40	80	40	40	20	20	20	20	20	20	20
HAWAII	20	20	20	40	40	80	20	20			15	15
INDIA	20	20				20	40	20			15	15
JAPAN	15	20	20									
MEXICO	15	20	20	40	40	20	20	20	15	15	15	15
PHILIPPINES												
PUERTO RICO	15	20	20	40	40	20	20	15	15	15	15	15
SOUTH AFRICA				40	40			15	15	15	20	20
U.S.S.R.	40	80	80	40	40	20	20	20	20	20	40	
WEST COAST	80	80	40	40	40	20	20	20	20	20	40	

## CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA												
ARGENTINA	20	40	40	40	80	80	20	20			15	15
AUSTRALIA	15	20	20	40	40	20	20	20	15	15	15	15
CANAL ZONE	20	40	40	40	40	20	20	15	15	15	15	15
ENGLAND	40	40	40	80	40	20	20	20	20	20	20	20
HAWAII	15	20	20	40	40	80	20	20			15	15
INDIA	20	20				20	40	20			15	15
JAPAN	15	20	20									
MEXICO	15	20	20	40	40	20	20	20	15	15	15	15
PHILIPPINES												
PUERTO RICO	15	20	20	40	40	20	20	15	15	15	15	15
SOUTH AFRICA	20	40	40					15	15	15	20	20
U.S.S.R.	40	80	80	40	40	20	20	20	20	20	40	

## WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	20	40	40	40	40	40	40	40	20	20
ARGENTINA	15	20	20	40	40	40	40	40	40	15	15	15
AUSTRALIA	15	20	20	40	40	40	40	40	40	15	15	15
CANAL ZONE	20	40	40	40	40	40	40	40	40	15	15	15
ENGLAND	40	40	40	80	40	20	20	20	20	20	20	20
HAWAII	15	20	20	40	40	80	20	20	20		15	15
INDIA	20	20				20	40	20			15	15
JAPAN	15	20	20									
MEXICO	15	20	20	40	40	20	20	20	15	15	15	15
PHILIPPINES												
PUERTO RICO	15	20	20	40	40	20	20	15	15	15	15	15
SOUTH AFRICA	20	40	40					15	15	15	20	20
U.S.S.R.	40	80	80	40	40	20	20	20	20	20	40	
EAST COAST	80	80	40	40	40	20	20	20	20	20	40	

Table for open only times or better during month. \*Fig. may happen later. (Sunset, 18:00; Sunrise, 06:00)

## DECEMBER 1994

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G-F	3 F-P
4 P	5 P-F	6 F	7 G-F	8 F	9 F-G	10 F
11 F-G	12 G	13 G-F	14 F	15 F-G	16 G-F	17 F
18 F	19 F-G	20 F-G	21 F	22 F-P	23 P	24 P-F
25 F	26 F	27 F-G	28 F-G	29 G-F	30 F	31 F-G

# BARTER 'N' BUY

Number 28 on your Feedback card

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and \$1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the 73 Magazine, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the January 1994 classified ad section is November 10, 1994.

BNB292

**ALL ABOUT CRYSTAL SETS.** Theory and construction of crystal set radios. \$9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192.

BNB200

**SUPERFAST MORSE CODE SUPEREASY.** Subliminal cassette, \$12.00. LEARN MORSE CODE IN 1 HOUR. Amazing supereasy technique, \$12.00. Both, \$20.00. Moneyback guarantee. Free catalog: SASE, **BAHR-77**, 150 Greenfield, Bloomington IL 61010.

BNB221

**ROANOKE DOPPLER PC BOARDS** \$49.95 ea. **AB5CK**, 6721 Rolling Hills Dr., North Richland Hills, TX 76180.

BNB240

**WANTED: AUDIO EQUIPMENT.** Tube, Solid State, McIntosh, Marantz, Tannoy, EV-Patronics, Western Electric, Nakamichi preferred. John, (410)465-2699.

BNB268

**KPC-3 WINDOWS TERMINAL PROGRAM** User friendly Split Screen, 400 line Scrollback Buffer, Save & Send files easily, 3D Command Buttons, \$29.95 or SASE for FREE details.

**COMTEK P.O.** Box 4101, Concord NH 03302-4101.

BNB271

**QSL SAMPLES**—50 cents. **SAM-CARDS**, 48 Monte Carlo Dr., Pittsburgh PA 15239.

BNB275

**DWYER WIND SPEED INDICATOR** only \$55.00 plus \$4.00 S/H. For home or office. Accurate, low-cost, practical. Roof mounted pickup. Send check or M.O. to: **RAD-MON COMPANY**, Dept A, Box 751, Marathon NY 13803-0751. (NY Residents add Sales Tax)

BNB285

**ATTENTION HAMS!** Subscribe to 6-50 Worldwide for Six Meter Enthusiasts, DX Digest for DX Chasers, or The Novice/Tech Report. Call (817)694-4047 or FAX (817)694-2522.

**COMMODORE 64 REPAIR.** Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO**, 10715 SW 190th Street #9, Miami FL 33157. (305)238-3327.

BNB295

**KIT BUILDERS**—NEW, SYNTHESIZED qrp Transmitter/Transceiver, the ARK4. Full Transceiver Kit w/case only \$199.95. One board, no wiring, top quality components & PCB. **GUARANTEED TO WORK.** For info send SASE; Call/Write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661.

BNB304

**WANTED: Electron Tubes, ICS, Semiconductors.** **ASTRAL**, P.O. Box 707ST, Linden NJ 07036. Call (800)666-8467.

BNB307

**KENWOOD AUTHORIZED REPAIR.** Also ICOM, Yaesu. **GROTON ELECTRONICS**, Box 379, Groton MA 01450. (508)448-3322.

BNB310

**UNIQUE INDOOR/OUTDOOR ANTENNA** gives 30 dB gain on 160m-10m. Plans: \$6.95. **BOB CHRISTIE AA2KE**, 215-28 Spencer Ave., Queens Village NY 11427.

BNB319

**GMRS: ALTERNATIVE TO CB AND HAM RADIO.** Great for traveling, camping or other family use, 2ed. Send \$3.00 to: Neiford, KG8EP, 2695 Haystack Dr., Colorado Springs CO 80922.

BNB326

**PROGRAMMABLE COUNTER**—Works with ANY VFO Rig! Get a digital display for your rig, 100 Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40 Mhz, up OR down. Counter Kit, \$69.95; Kit w/case, \$99.95; Assembled w/case, \$139.95. **GUARANTEED TO WORK.** For info send SASE; Call/write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661.

BNB334

Continued on page 81

# NEW PRODUCTS

Number 29 on your Feedback card

Compiled by Charles Warrington WA1RZW



## CABIN FLAT ENTERPRISES

Now amateur radio operators can identify themselves when working communications for public events or emergency services. These new Cab-

in Flat T-Shirts feature front breast "Federally Licensed Radio Operator" logo insignia. The back reads "Emergency Communications" in large letters to identify your status.

The shirts are high quality 100% cotton, available in sizes L, XL, and XXL in navy blue with white printing. They are priced at \$17 each. Special matching caps and jackets are also available. For more information or to order contact Cabin Flat Enterprises, 23236 Cardinal Road, Box 2423, Wrightwood, CA 92397; (619) 249-5832, (800) 435-3528, FAX (619) 249-4667. Or circle Reader Service No. 203.

## JADE PRODUCTS

The new series of Jade-Pole Antennas from Jade Products is based on a conventional J-pole design using ladder-line technology. They are available for the 2 meter, 220 MHz, and 6 meter bands.

The Jade-Poles are constructed of heavy-duty #18 copper-clad steel conductor and comes with a standard SO-239 connector. The antenna is rated at 300 watts and is usable over the entire band of operation using a 50 ohm coax feedline.

The 2 meter and 220 MHz versions come completely assembled and ready for installation; minor assembly is required for the 6 meter version—complete instructions are included. The an-

tenna is colored white and comes ready to mount on a wall or on to a mast with the optional mast mounting kit. The 2 meter version is priced at \$28.95, the 220 MHz version is priced at \$27.95, and the 6 meter version is priced at \$37.95. For more information contact Jade Products, P.O. Box 368, E. Hampstead, NH 03826-0368; (603) 329-6995, FAX (603) 329-4499. Or circle Reader Service No. 202.



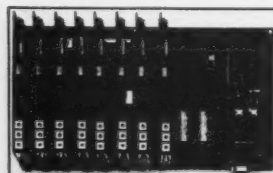
## S & S ENGINEERING

Okay guys, here it is! For those of you with offset VFOs who want to read the tuned frequency, S & S Engineering has developed the PC1 Programmable Frequency Counter. Just set the DIP switches for the offset, connect it to your VFO (instructions are

free when you provide the schematic for your VFO), and attach 7-15 VDC. You will then know your tuned frequency with accuracy.

The PC1 counts to 40 MHz up or down. It handles any IF offset and backward tuning VFOs. It makes using a VFO rig a pleasure.

The case is just 4" W x 2.5" H x 5.5" D, and the easy to read LED display draws only 150 mA. The PCB is solder masked for easy assembly. The PC1 (kit, no case) is priced at \$69.95; the PC1C1 (kit with case) is \$99.95; the PCA1 (assembled with case) is \$139.95, and the AC adapter is \$6.95. For more information or to order contact S & S Engineering, 14102 Brown Road, Smithburg, MD 21783; (301) 416-0661, FAX (301) 416-0963. Or circle Reader Service No. 205.



## LINK COMMUNICATIONS

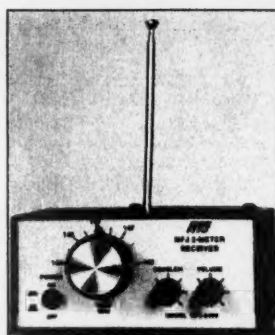
Link Communications Has announced the release of the new RLC-3 Repeater, linking and remote base controller. The RLC-3 supports up to 8 separate or connected radio ports, on one controller system. Each radio port can function as a repeater, link or remote base. The RLC-3 supports sepa-

## MFJ ENTERPRISES

Are you a true ham who loves to build his own gear? True hams will love the new MFJ-8400K Repeater Monitor Receiver Kit for the 2 meter band. With MFJ's build-your-own instructions, you'll enjoy a fun evening building your own high quality tunable receiver and you'll enjoy the finished super-sensitive receiver monitor that'll rival others costing hundreds of dollars more.

The 8400-K features a low-noise, high gain RF preamp which gives you excellent 0.1 microvolt sensitivity. An air variable tuning capacitor with a velvet smooth 6:1 reduction drive makes tuning easy and comfortable with no noticeable drift. The dual conversion superhet design has sharp ceramic filters and a crystal controlled second oscillator for excellent selectivity and sensitivity.

The MFJ-8400K is a complete kit priced at \$69.95, and uses a 9 volt battery, 9-12 VDC or 110 VAC with optional MFJ-1312B (priced at \$12.95.)



The MFJ-8400W is the same radio, prewired and tested, and priced at \$89.95. The instruction manual is available free of charge. For more information or to order visit your favorite dealer or contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (voice) (601) 323-5869, FAX (601) 323-6551, (orders) (800) 647-1800. Or circle Reader Service No. 201.

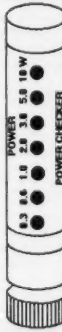
## RADIO DEVICES

Radio Devices is the sole US importer of the new PC705 Power Checker from Revex. This little gadget is a handy RF measurement device that shows the RF power output of low power transmitters (less than 10 watts) in the 20-1300 MHz range. The Power Checker illuminates up to 8 LEDs based on the power applied through the BNC connector.

Simply attach the Power Checker to any HT and you can immediately read the power output and evaluate the status of your batteries. It can also be

used as an antenna for short-range communications. No external power is required; the Power Checker is powered purely by the RF applied.

The PC705 is priced at \$39.95 (plus \$2.90 First Class shipping). For more information or to order contact Radio Devices, 32 Queens View Road, Marlboro, MA 01752; (508) 480-0502. Or circle Reader Service No. 204.



## OPTOELECTRONICS

Here's a new device not intended to be used as a test instrument, but rather to detect radio transmitters in the near field. The Scout automatically finds and records frequencies and tunes a



receiver. It is the first such device created for this purpose.

For walk-by applications, the Scout can automatically detect and record 200 unique frequencies and up to 250 repeat hits on any that were previously recorded. When used with the miniature DB32 antenna, the Scout will fit in the pocket, operate completely automatically, and will signal the operator when a signal is recorded with a

pager-style vibrator. After recording, the data can be downloaded into a computer using the software supplied and an optional TTL to RS-232C converter.

In drive-by mode, the built in beeper signals when the Scout records a new frequency with a double beep. A single beep indicates a repeat hit. Because the Scout is automatic, the driver is not distracted, but can easily monitor activity.

The Scout runs on a high capacity NiCd battery pack has a wide variety of power options, and comes with an AC adapter charger, 3.5" disk with PC compatible utilities, and a comprehensive owner's manual. The Scout is priced at \$399. For sales or technical information contact Optoelectronics, Inc., 5821 NE 14th Ave., Ft. Lauderdale, FL 33334; (305) 771-0205, FAX (305) 771-2052. Or circle Reader Service No. 207.

autopatch option is \$100; analog input and output card is \$75; and additional radio cards are \$250. For more information contact Link Communications, Inc., P.O. Box 1071, Sidney, MT 59270; (406) 482-7515, (800) 610-4085. Or circle Reader Service No. 206.

## BARTER 'N' BUY

Continued from page 79

**RCI-2950/2970:** New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only \$20.00 ppd in U.S. (Missouri residents add \$1.15 tax). **SCOTT**, P.O. Box 510408, St., Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D.

BNB340

**HR2510, RCI2950, CONNEX 3300, COBRA 148, GALAXY SATURN**, plus many more kits to increase your modulation, \$19.95. (800)536-0109. BNB350

**Icom R-9000 Receiver**, 4 months old, orig. box, under manufacturer warranty, 100 kHz-2GHz. **Collin B. Anderson**, (H) 703-524-5530; (W) 703-697-4712. (I work 2 p.m.-11 p.m. M-F ET. BNB360

**QSL CARDS** — Standard and custom. Your ideas or ours. Excellent quality. Foil stamping available. Many designs and type styles. Catalog and samples \$1.00 refundable. **WILKINS**, Dept. A, Box 787, Atascadero CA 93423. BNB370

**CALLSIGN WRISTWATCH** - Free details. **KC6UEC**, 9438 Broadway, Temple City CA 91780. BNB379

**NEW NN1G CW SUPER-HET SINGLE BAND TRANSCEIVER KIT**. Available in 20M, 30M, 40M, 80M. \$59.95 plus \$3.75 S/H. (Catalog-2 Stamps). **DAN'S SMALL PARTS & KITS**, 1935 South 3rd West #1, Missoula MT 59801. BNB385

**CW'ers, USN FLAMEPROOF KEY**, new, packed 1955, \$59 (shipping included). Collectors, 15 pages, mostly telegraphic, refundable \$2.00 plus 2 Stamps. **Joseph Jacobs**, 60 Seaview Terr., Northport NY 11768. BNB393

**IT'S BACK!** The return of the HW-8 Handbook! Second printing. Modifications for the Heath QRP rigs. First class mail \$11. DX add \$4 for air mail shipping. **Mike Bryce, W8BVG**, 2225 Mayflower NW, Massillon OH 44647. BNB404

**47 FOOT ANTENNA WORKS ALL BANDS**. Only \$40.00 ppd in 48 states. Fully assembled, not a kit. Superb results! Satisfaction guaranteed 100%. SASE for catalog and information sheet. **THE ANT FARM, P.O. Box 3196, Wescosville PA 18106**. BNB409

**ULTIMATE CONSTRUCTION** directions for inexpensive project to determine accurate beam direction for DX from your QTH. For plans send SASE and \$5.00 to: **KA1EHG/1**, Box 11, North Bridgton ME 04057-0011. BNB417

**MAHLON LOOMIS, INVENTOR OF RADIO**; (patented 1872) by Thomas Appleby. (Copyright 1967). Available from **JOHAN K.V. SVANHOLM, N3RF, SVANHOLM RESEARCH LABORATORIES**, P.O. Box 81, Washington DC 20044. Please send \$25.00 donation with \$5.00 for S&H. BNB420

**BROWNIES QSL CARDS SINCE 1939**. Catalog & samples \$1 (refundable with order). 3035 Lehigh Street, Allentown PA 18103. BNB430

**BUTTERNUT ANTENNAS, NEW**—in box. (2)HF6-VX, \$125.00; (2)HF5B, \$200.00; (2)HF2V, \$110.00; (1)HF7VX, \$150.00. (210)435-6190. BNB435

**RADIO DOCTOR VIDEOS** for Repair and Alignment of HF Transceivers. Reviewed by Gordon West, January—73 Magazine. Videos for popular KENWOOD, YAESU, and ICOM. ORDERS: (800)788-1416 MC/VISA. Catalog: SASE (2 stamps): **RADIO DOCTOR**, 710 Teague Dr., Kennesaw GA 30144. BNB442

### TNT FIELD DAY ANTENNA

complete, assembled/ready to use.

No pruning.  
TNT is No-tune on 80, 40, 20, 17, 15, 10, 10. Work other bands w/ tuner. DX & Gain rise w/ frequency.  
Ready to Use  
Includes isolation balun & 99 ft RG8x  
The modern coax-fed version of the classic off-center fed antenna.  
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No tuning.  
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No knots to twist.  
TNT/2 is No-tune on 40, 20, 10. Traps or Resistors Insulated in 3000 V Rated 500 Watts

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**Antennas West**  
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CIRCLE 135 ON READER SERVICE CARD

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### MORSE CODE MUSIC!

**SENSATIONAL NEW WAY TO LEARN CODE—Do Aerobics, Sing, Jog, or Drive while learning code!** A fun & easy way to learn or retain Morse Code skills. Now the secret is yours with this amazing synchronized breakthrough! Great fun tape for all licenses and classrooms! Order:

**"THE RHYTHM OF THE CODE"**  
Version 2 cassette today!

Send \$9.95 and include \$2.00 S/H to:

**KAWA RECORDS**

P.O. Box 319-ST

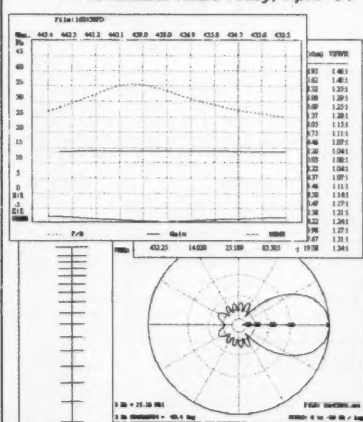
Weymouth, MA 02188

Check or money order only. We ship all orders within 5 days.  
MA residents add 5% sales tax.

CIRCLE 2 ON READER SERVICE CARD

### "DESIGNING A YAGI HAS NEVER BEEN SO EASY!"

... 73 Amateur Radio Today, April '94



Why spend big \$ on unfriendly, overpriced and very slow optimize-only software ???

**Quickyagi**, the high speed, low cost, easy-to-use software features auto design & optimize plus performance analysis. With amazing accuracy, it will accommodate 17 elements, Freq. to 1 GHz, mtg/boom and tapered element modeling, folded dipole, scalar, and prints all files, polar plots and graphs. Both co-proc. & no co-proc. versions are included. For PC-AT w/ 840 K RAM, VGA, EGA, CGA, Herc and DOS 3.0 or higher

**Quickyagi v3.1 \$39.95**  
By WA7RAI

Add \$3.00 s&h or \$5.00 for non-USA orders + Incl. Callsign worder  
Send SASE for complete info. • US Check or Internat'l Money order  
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### UNIVERSAL IR REMOTE CONTROL

The Fox 400™ wireless infrared remote control works with most TVs, VCRs, cable and audio devices. Works with all major brands and lots of not-so-major brands. Use it to replace lost IR remotes or to combine up to four remotes into one unit. User friendly. Includes complete instructions and an 800 phone help-line if problems should occur. Fully guaranteed. Requires 3 AAA batteries (not included).

CAT #  
IR-400

**\$11.75**  
each

### MINIATURE TOGGLES

**S.P.D.T. (ON-ON)**

Right-angle, pc mount.  
0.25" threaded bushing  
Rated 5 amps @ 125 Vac.

CAT# MTS-4RT

10 for \$7.00 • 100 for \$65.00

**D.P.D.T. (ON-ON)**

ALCOWITCH # MTM206NPC  
Short bat handle, 0.25" long.  
PC terminals.

CAT# MTS-82PC **\$1.25**  
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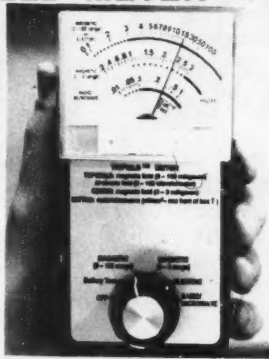
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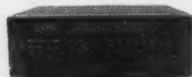


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### Specifications

- Remote Front Panel Design
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- SP-7 Mobile External Spkr.
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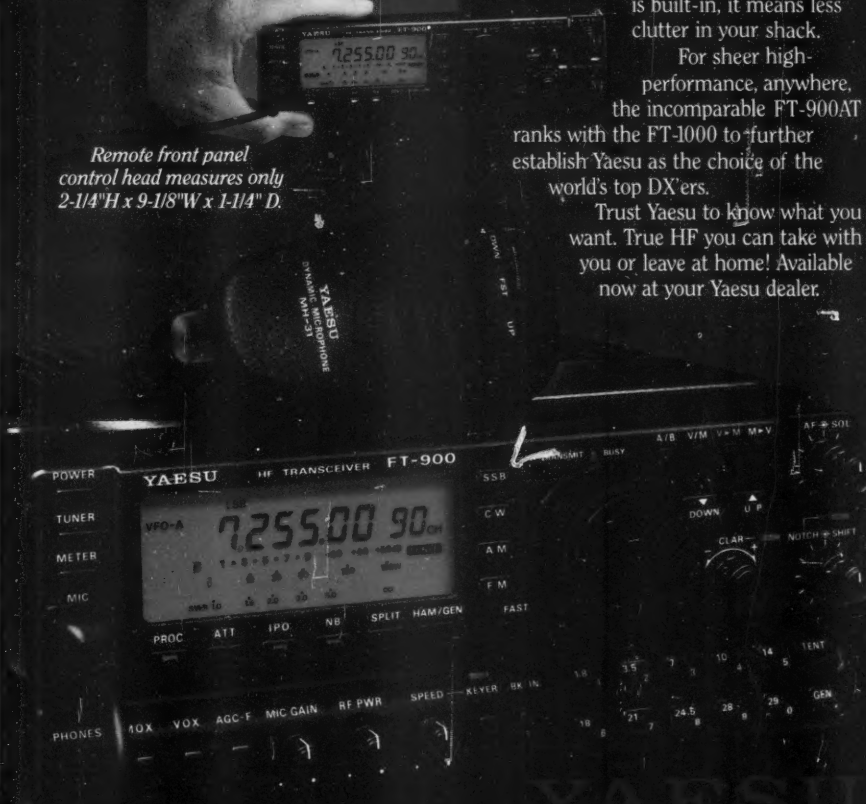
*The FT-900AT controls mount almost anywhere in your car, truck or camper. 100 Watt RF deck can mount in trunk, or under seat.*

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# On-Board Guidance System



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### Features

- 2.7W approx. output (144MHz), 2W approx. output (440MHz) from MOS FET power module and supplied 6V battery; 5W approx. output using optional PB-34
- Dot-matrix LCD with menu/guide system
- 82 non-volatile memory channels with ID
- DTMF keypad with memory function
- DTSS (Dual-Tone Squelch System) with page
- Built-in CTCSS tone encoder/decoder
- Automatic band change
- Power-on call sign display
- Auto repeater offset (VHF)
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